SOURCE CONTROL EVALUATION REPORT
MCCALL OIL AND CHEMICAL SITE

Prepared for

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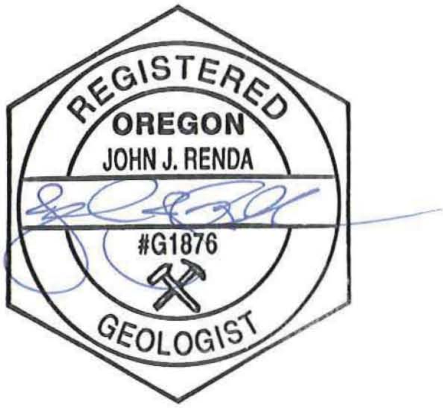
Source Control Evaluation Report
McCall Oil and Chemical Site

The material and data in this report were prepared under the supervision and direction of the undersigned.



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1 SUMMARY OF FINDINGS

An assessment of the stormwater, storm sediment, groundwater, and bank soil at the McCall Oil and Chemical Corporation (MOCC) Site (Site) was performed to determine whether historical or ongoing Site activities may be impacting the beneficial uses of the Willamette River. Of primary concern are the ecological and human receptors of the Willamette River. The primary exposure pathways include direct contact of aquatic organisms with contaminants in river water or sediment, ingestion of contaminated fish or shellfish from the river by humans or wildlife, and consumption of drinking water from the river. Upland exposure pathways for industrial (occupational) Site workers, trench and construction workers, and terrestrial wildlife are separately evaluated in the Remedial Investigation Report for this facility (Anchor 2008).

The following transport pathways were evaluated in this report:

- Stormwater discharges to the Willamette River
- Storm sediment runoff and deposition in the Willamette River
- Groundwater seepage to the Willamette River
- Bank soil erosion to the Willamette River

The following constituents of interest (COIs) were evaluated in all media:

- Metals (arsenic, cadmium, chromium, copper, lead, and zinc)
- Total petroleum hydrocarbons (TPH, as diesel, oil, and gasoline)
- Polycyclic aromatic hydrocarbons (PAHs)
- Miscellaneous semivolatile organic compounds (SVOCs including 4-methylphenol, butyl benzyl phthalate, di-n-octyl phthalate, and dibenzofuran)

In addition, polychlorinated biphenyls (PCBs) were evaluated in Site stormwater and storm sediment, considering they are a key risk driver in the Portland Harbor Superfund Site, and volatile organic compounds (VOCs) were evaluated in Site groundwater, given their historical use and occurrence at the Site.

The source control screening evaluation follows the step-wise process outlined in Oregon Department of Environmental Quality (DEQ) guidance for source control decision-making at stormwater sites (DEQ 2009; Figure 2). Following are the key findings of this evaluation:

1) **Comparison to Joint Source Control Strategy (JSCS) Screening Level Values (SLVs).** In stormwater, copper, lead, and zinc were carried forward for further evaluation on the basis of ecological risk, and HPAHs (high molecular weight PAHs) were carried forward based on exceedances of fish consumption criteria. In groundwater, arsenic was carried forward based on exceedances of human health criteria (fish consumption and drinking water). In catch basin sediment, all of the COI metals were carried forward based on exceedances of ecological SLVs and/or human health SLVs; LPAHs (low molecular weight PAHs) and HPAHs were carried forward based on exceedances of ecological criteria, and PCBs based on exceedances of human health criteria. No river bank soil samples exceeded any of the ecological or human health screening criteria for any COIs.

2) **Effectiveness of MOCC Source Control Measures (SCMs).** More than 10 years of National Pollution Discharge Elimination System (NPDES) monitoring data were statistically analyzed using least-squares regression techniques. This analysis indicates concentrations of total suspeneded solids (TSS), metals, and to some degree organic constituents are decreasing over time in response to the SCMs that have been implemented at the Site. Control of TSS is expected to provide added benefits for other contaminants that are associated with suspended sediments, such as particulate-bound metals and hydrophobic organics (e.g., HPAHs, bis(2-ethylhexyl)phthalate).

3) **Comparison with Data from Comparable Sites.** Comparison of Site stormwater data with comparable industrial sites in the Portland Harbor shows substantially lower concentrations (i.e., two to ten times lower) at the Site compared to those typically observed for this land use. Similarly, catch basin sediment data at the Site is generally at or below concentrations from other industrial sites. These comparisons provide evidence that the SCMs being implemented at the Site result in stormwater and storm sediment quality that is generally comparable or better than the industrial standard for the Portland Harbor.

4) **Evaluation of Impacts to Willamette River.** Sediment concentrations of COIs in the Willamette River adjacent to the Site are well below probable effects concentration (PEC) values and in many cases near or below threshold effects concentration (TEC) values and background concentrations. Bioassay tests at three locations showed no effects on

benthic organisms. Sediment concentrations adjacent to the Site are similar or lower than those observed at locations directly upstream and downstream. Similarly, contaminant residue concentrations in the tissues of river organisms and laboratory bioaccumulation test organisms show that metals concentrations adjacent to the Site are similar to upstream concentrations and harbor-wide mean values, while the concentrations of organic contaminants (PAHs and PCBs) adjacent to the Site are consistently lower than upstream concentrations and harbor-wide mean values. In combination, these observations provide a consistent weight of evidence that current or historical discharges from the Site have not caused any substantive impacts to sediment quality or tissue contaminant residues in the river.

In summary, the weight of evidence established during the source control screening evaluation shows that SCMs have been effective at reducing contaminant loads from the Site, stormwater quality at the Site is better than average for heavy industrial land use, there is no evidence of impacts to Willamette River sediments from Site discharges, and in general, source control is in place at this facility. Furthermore, MOCC's NPDES stormwater permit will ensure that source controls remain functional and effective in the foreseeable future. Therefore, we request that DEQ issue a favorable Stormwater Source Control Decision for this Site.

2 INTRODUCTION

2.1 Background

The Site is located in the industrialized area of northwest Portland along NW Front Avenue (see Figure 1). It occupies approximately 36 acres on the southwest bank of the Willamette River. The property is currently occupied by three separate facilities: MOCC, which operates a marine terminal and asphalt facility, Brenntag Pacific (Brenntag), which operates the former Great Western Chemical Corporation (GWCC) chemical distribution facility, and High Purity Products, which operates the northernmost facility on the former Great Western Property.

Before 1966, most of the land now occupied by the MOCC Oil Terminal was submerged beneath the Willamette River (Figure 2). The Port of Portland (Port) created new land along the Willamette during the mid-1960s by dredging and filling along the shore. This land, including a portion of the Site, was deeded to the Port by the State of Oregon in 1967. A detailed description of the ownership and operational history of the Site is in the *McCall Oil and Chemical Corporation Focused Remedial Investigation Workplan* (Workplan) (IT Corporation 2000), and in the Remedial Investigation (RI) Proposal, which is Appendix D to the Workplan.

Until 1995, the GWCC facilities consisted of two operating units, the GWCC Technical Center and the GWCC Portland Branch. The Technical Center included the former Chemax operations. In 1995, GWCC's two operating units were merged into the Portland Branch. Current and historical activities associated with the operations of each of these facilities are discussed in detail in chapters two through five of the RI Proposal (Appendix D to the Workplan).

The Site is included in the Willamette Greenway (Greenway) established by the City of Portland to monitor and control land use next to the river. The Site and surrounding properties are zoned for heavy industrial use, both within the Greenway on the northwest (i.e., downriver) bank and outside of the Greenway. Surrounding industries include petroleum bulk distribution terminals, chemical plants, sand and gravel operations, a steel fabrication facility, shipyards, and rail yards.

In the mid-1920s, the Port purchased the property now occupied by MOCC and Brenntag as part of an approximately 65-acre parcel that stretched from the lands now owned by Conoco/Phillips on the west, to the Willamette River. Prior to the mid-1940s the property was vacant. In 1946, Pioneer Flintkote Company (Flintkote) purchased two parcels from the Port. Those parcels are currently occupied by Brenntag and the MOCC asphalt plant, respectively.

Flintkote manufactured asphalt roofing shingles and tiles on the property from 1947 to approximately 1982. Historical occupation records indicate that Standard Oil Company operated a distribution center at the Site during the 1950s (SAFE 1994). By 1960, Douglas Oil Company (Douglas) occupied this address and operated an asphalt facility. In 1962, Douglas purchased the facility from Flintkote. Douglas and Flintkote continued to operate their respective facilities until 1982, when both parcels and the improvements were sold to MOCC. Chemax began operations on the former Flintkote site in early 1984. The Portland branch began its on-site operations in late 1985. In 1985, MOCC operated a lube oil distribution facility on part of the asphalt plant site. The lube oil operations were discontinued in 1991.

In the early to mid-1960s, the Port used dredge spoils from the Willamette River channel (primarily fine sand) to create new land along the Willamette River next to the Flintkote and Douglas facilities. As stated previously, this land was subsequently deeded to the Port by the state of Oregon in 1967. In the mid-1970s, MOCC constructed the marine terminal on the filled land. MOCC purchased the marine terminal land from the Port in 2004.

2.2 Purpose

This report provides a risk screening evaluation of Site stormwater, groundwater, catch basin sediment, and bank surface soils to provide an assessment of potential impacts to the Willamette River from historic and current Site industrial operations. Exposure pathways for river receptors include protection of direct toxicity to aquatic life via water and sediment, and protection of human health via fish consumption and drinking water. This report will show that the environmental information obtained by MOCC and the Lower Willamette Group (LWG) indicate Site operations have not impacted beneficial uses of the Willamette River, and source control is in place and functioning effectively at this facility.

2.3 Report Organization

The remainder of this report is organized as follows:

- **Section 3.** Section 3 develops the conceptual site model (CSM) of Site sources, transport pathways, and receptors, and identifies Site COIs to carry through the risk screening evaluation. This section also provides a summary of historic releases and cleanup actions at the Site and neighboring properties.
- **Section 4.** Section 4 provides a summary of sediment chemistry, tissue chemistry, and toxicity studies conducted in the Willamette River adjacent to the Site by the LWG.
- **Section 5.** Section 5 provides the results of the step-wise risk screening evaluation of stormwater, storm sediment, and bank soil. The screening evaluation includes a comparison of Site environmental data with JSCS SLVs, an assessment of the effectiveness of Site SCMs, a comparison of Site data with other industrial sites in Portland Harbor, and an assessment of possible Site impacts to the adjacent Willamette River.
- **Section 6.** Section 6 provides a concise summary of the results of the risk screening evaluation presented in Section 5, and an overall assessment of the status of source control at the Site.

3 CONCEPTUAL SITE MODEL

This section of the report describes the risk exposure pathways that could potentially impact ecological and human receptors in the Willamette River, the environmental media and COIs that are related to Site uses and operations, and potential source areas in and around the facility.

3.1 Potential Exposure Pathways

The CSM, shown on Figure 3, identifies the sources, pathways, and receptors that will be evaluated to assess the status of source control at this facility. Although MOCC and Brenntag operate independently, the CSM covers both facilities because the two facilities are adjacent to each other and have potentially overlapping exposure pathways. Of primary concern to this report are the ecological and human receptors of the Willamette River. Upland exposure pathways for industrial (occupational) Site workers, trench and construction workers, and terrestrial wildlife are evaluated in the RI Report for this facility (Anchor 2008). Because these pathways do not directly impact the beneficial uses of the Willamette River, they are not considered further in this report.

The following transport pathways will be considered in this source control evaluation:

- Stormwater discharges to the Willamette River
- Storm sediment runoff and deposition in the Willamette River
- Groundwater seepage to the Willamette River
- Bank soil erosion to the Willamette River

Once contaminants enter the river via one or more of these transport pathways, the contaminants may come to reside in the river water, bottom sediment, or in the tissue of fish or other aquatic organisms. There are several possible routes of exposure for ecological and human receptors:

- Direct contact of aquatic organisms with contaminants in water and/or sediment
- Bioaccumulation of contaminants in the tissues of fish or shellfish, and propagation of these contaminants through the food web via ingestion of contaminated fish or shellfish by humans or wildlife
- Use of the Willamette River as a drinking water source, and ingestion of contaminated river water

Recreational users of the Willamette River are unlikely to contact sediments and shallow river water adjacent to the Site during swimming and wading activities because the Site and surrounding properties are industrial in nature with no public access facilities. These are therefore considered insignificant pathways.

3.2 Description of Exposure Pathways

This section provides general descriptions of the primary transport pathways linking the Site to the Willamette River, i.e., surface water (stormwater and storm sediment) and groundwater transport pathways. Further information on surface water, groundwater, and soil investigations can be found in RI Report (Anchor 2008).

3.2.1 Surface Water Pathway Description

The Site storm drain system is shown on Figure 4 and additional details are provided in Appendix A.

Stormwater from the Site enters the river via three outfalls. Stormwater from Site catch basins S-1, S-2, and others along Front Avenue discharges to the City storm sewer and ultimately the City of Portland outfall COP-022. In addition to stormwater from the Site, outfall COP-022 receives stormwater from a very large drainage area, including city streets, commercial, and industrial facilities. Stormwater from the Brenntag facility discharges to the river at Outfall S-3. Stormwater from the MOCC Marine Terminal and portions of the asphalt plant discharges to the Oil/Water Separator and from there to Outfall S-4.

The entire facility is paved, with two exceptions. The rectangular shaped area between the Brenntag facility and the MOCC Marine Terminal has a gravel surface. Although it is unpaved, vehicle traffic has compacted the gravel, creating a low permeability surface that causes much of the incident rainfall to runoff to the catch basins in this area. Stormwater from those catch basins flows to the MOCC oil-water separator located at S-4. The area within the MOCC terminal above-ground tank farm is also unpaved. Some infiltration may occur in this area, although much of the rainwater that falls into the tank farm also runs off and is routed to the oil water separator at S-4.

There are three private stormwater outfalls on the river shoreline near the boundary of Front Avenue LLP property and MOCC property (Figure 4). These outfalls apparently receive stormwater from the three properties currently owned by Front Avenue LLP, including Glacier Northwest, Tube Forgings, and CMI Northwest.

3.2.2 Groundwater Pathway Description

Based on soil borings and monitoring wells advanced during the RI, there are three geologic units of interest underlying the uplands at the Site. The uppermost geologic unit is dredge fill derived from the Willamette River, placed in the 1960s by the Port of Portland, and later developed by MOCC as a marine terminal above-ground tank farm. The dredge fill overlies river alluvium, which overlies basaltic bedrock. The shallow alluvial aquifer consists of the combined sequence of dredge fill and alluvium, approximately 75 feet thick, which forms a single hydrogeologic unit. The combined unit consists of interbedded fine- to medium-grained sand and silt, with an indistinct lithologic contact between the base of the fill and the upper alluvium (Anchor 2008).

Because most of the Site is paved, groundwater in the alluvial aquifer is recharged primarily by underflow from areas to the south (Tube Forgings) and to the west (Chevron Asphalt and Willbridge terminals). The groundwater flows in a northerly direction toward the Willamette River, with some convergence of flow lines toward the embayment near the S3 outfall. Although there are seasonal changes in water level and gradient, the northerly flow direction is relatively consistent throughout the year. A detailed description of Site hydrogeology, including groundwater potentiometric surface maps, is in the RI Report (Anchor 2008).

3.3 Contaminants of Interest (COIs)

The Site COIs were selected on the basis of chemicals that were 1) historically or currently used or stored at the facility, or at adjacent facilities, 2) detected in adjacent Willamette River sediment samples, or 3) detected in Site stormwater. The classes of COIs historically or currently used or stored at the Site include:

- Arsenic, chromium, and copper (associated with the historical production of wood-treating chemicals)
- TPH as diesel and oil

- PAHs
- Chlorinated VOCs

Because of the extended history of petroleum storage, handling, and shipping at the various bulk terminals in the vicinity of the Site, the following COIs were included in the investigation, although no significant on-site sources of these chemicals are known:

- TPH as gasoline
- Benzene, toluene, ethylbenzene, xylenes (BTEX)

During the initial Portland Harbor Sediment Investigation (Weston 1998), which ultimately helped support the Superfund listing of the Portland Harbor, the U.S. Environmental Protection Agency (EPA) collected and analyzed sediment samples from several Willamette River locations near the Site. Four SVOCs were detected in these sediments at concentrations above Portland Harbor "baseline" levels, and as a result, these SVOCs were added to the list of COIs for the Site:

- Miscellaneous SVOCs (4-methylphenol, dibenzofuran, butyl benzyl phthalate, and di-n-octyl phthalate)

Finally, several metals were added to the list of COIs based on their occurrence in Site stormwater:

- Cadmium, lead, and zinc

In summary, the following COIs were identified for the RI of the Site and are adopted for use in this Source Control Evaluation Report:

- Metals (arsenic, cadmium, chromium, copper, lead, and zinc)
- TPH (as diesel, oil, and gasoline)
- PAHs
- Miscellaneous SVOCs (4-methylphenol, butyl benzyl phthalate, di-n-octyl phthalate, and dibenzofuran)
- BTEX
- Chlorinated VOCs

This list of COIs was presented in the RI Workplan for the Site and was subsequently approved by DEQ. In some cases, an expanded list of analytes was requested from the laboratory (e.g., additional metals, phthalates, etc.) and is included in the evaluation.

3.4 Potential Upland Sources and Historical Releases

3.4.1 MOCC and GWCC Sites

From 1955 to the present, MOCC and the previous owner, Douglas Asphalt, have kept careful records of accidental releases that occurred during industrial operations. MOCC releases related to the Marine Terminal and asphalt plant are documented in Table 1. The history of environmental releases at GWCC is documented in Table 2.

Review of Tables 1 and 2 shows that most of the releases at the MOCC Oil Terminal and the asphalt plant consisted of petroleum products, including diesel, raw asphalt, and bunker C. The table also shows the response actions taken to clean up each release. Most of the releases at the GWCC facility were various acids.

The GWCC release history includes a 1992 release of copper-chrome-arsenic (CCA) that occurred at the CCA process area of the GWCC plant. In cooperation with DEQ, excavation and off-site landfill disposal of CCA contaminated soil was completed. The details of the CCA soil cleanup are provided in Appendix D of the RI Workplan. Monitoring wells MW-1, -2, -3, and -4 were installed to assess possible groundwater quality impacts from the CCA release.

Transient Light Non-aqueous Phase Liquids (LNAPL) at Well MW-8. At well MW-8, petroleum hydrocarbons were logged in sand at a depth of 30 feet below ground when the well was being installed, but LNAPL has not been detected during subsequent sampling of the well (Anchor 2008).

Chlorinated VOC Groundwater Plumes. The largest area of chlorinated VOC contamination is a plume that originates near well EX-1 in the former solvent drumming area and extends in a northerly, downgradient direction to wells MW-7 and MW-8 near the river. A second area of chlorinated VOC contamination includes monitoring wells

MW-1, -2, -3, -4, and -10. A map of the VOC plumes is included in the Site RI Report (Anchor 2008).

3.4.2 Tube Forgings

Bunker C fuel was released from an underground storage tank (UST) on the Tube Forgings plant site near MOCC's southeastern property boundary. During the RI, bunker C NAPL was detected adjacent to the Tube Forgings property in the vicinity of monitoring well MW-11 (see Figure 4). This is the only occurrence of petroleum NAPL detected on the Site, aside from the temporary observation during installation of MW-8.

Cleanup of the underground storage tank bunker C release occurred on the Tube Forgings property, and the cleanup is documented in the Groundwater Investigation Report, Front Avenue LLP Site (Maul, Foster, Alongi, Inc. 2004). However, soil and groundwater data collected during the RI identified a zone of bunker C NAPL on the MOCC property adjacent to the former Tube Forgings UST. Forensic analysis conducted confirms that the LNAPL adjacent to the Tube Forgings property is bunker C. The LNAPL is not connected to any of the MOCC fuel storage facilities.

The RI (Anchor 2008) data indicate the bunker C NAPL is not migrating and will not migrate to the Willamette River. The bunker C NAPL is approximately 700 feet from the Willamette River shoreline and is not considered a threat to its beneficial uses.

3.4.3 Willbridge Terminal

Since at least the early 1970s, floating petroleum hydrocarbon products, primarily diesel, with some gasoline, have discharged to the Willamette River along the backfill of the former wood stave Doane Avenue storm sewer and along the backfill of the 1982 City of Portland replacement concrete storm sewer (COP-022). The storm sewer and Outfall 022 are located on Conoco/Phillips property within a few feet of the northwestern (i.e., downriver) property line (see Figure 4).

From the 1970s through the present, various oil companies have conducted free product recovery and cleanup actions on the shoreline near the COP-022 outfall. Historic petroleum product releases have occurred, and dissolved petroleum hydrocarbon plumes exist on the Chevron Asphalt and Conoco/Phillips tank farms located upgradient from the Site. The petroleum free product has migrated along the City storm sewer backfill to the river and as a result, the outfall location has been surrounded by floating petroleum containment booms.

Several of the LWG river sediment sampling sites were located very close to the COP-022 outfall. Petroleum-related COIs detected by LWG at sediment sample locations in this area may be at least partially sourced from historic free product discharges migrating along this utility corridor to the shoreline.

4 LWG SEDIMENT AND TISSUE QUALITY INVESTIGATIONS

4.1 Sediment Chemistry

The LWG Round 2 sediment sampling event included eight sediment sample locations adjacent to the Site, as shown on Figure 4. The upstream boundary of the Site with Tube Forgings, LLP is at approximate river mile 8.03 and the downstream boundary of the Site with Conoco/Phillips is at approximate river mile 7.8. Table 3a is a list of the LWG sediment sample sites adjacent to the Site, and within approximately ½ mile upstream and downstream of the Site boundaries on the western side of the river.

The following eight sampling locations are adjacent to the Site, from upstream to downstream:

- G413, C413
- G410
- G407
- G403, C403
- G399
- G391
- C532
- G404

The sample numbers with the "G" prefix are surface samples obtained the top 10 centimeters of the sediment, and those with the "C" prefix are subsurface core samples obtained from various deeper intervals.

The LWG sediment samples were tested for a wide range of analytes. Analytical results for the key COIs at the Site are summarized in Table 3a, including PAHs (LPAHs, HPAHs, and Total PAHs), metals (arsenic, chromium, copper, and zinc), and miscellaneous SVOCs (dibenzofuran, 4-methylphenol, and di-n-octylphthalate). In addition, analytical results for Total PCBs are also summarized. Although PCBs are not a Site COI, they deserved further evaluation because PCBs are a key contaminant of concern (COC) for the Portland Harbor, they are bioaccumulative, and were detected in samples from this reach of the river.

4.1.1 Downstream Trends in Concentration

A comparison of upstream, adjacent, and downstream sediment concentrations in the Willamette River for the Site COIs is summarized in Table 3a. At the bottom of the table are statistical summaries of the sediment quality data from upstream, adjacent, and downstream areas, including the arithmetic mean and median concentrations. Harbor-wide mean and median concentrations are also provided. Spatial plots of Site COI concentrations by river mile showing downstream trends in sediment quality, from upstream to downstream of the Site, are provided in Appendix B.

The following observations are evident from a spatial analysis of the sediment quality data:

- **Metals.** Mean and median metals concentrations adjacent to the Site are similar to mean and median harbor-wide values, showing no evidence of unusual enrichment. Arsenic and chromium concentrations adjacent to the Site are comparable to upstream and downstream concentrations in the river. Copper and zinc concentrations adjacent to the Site are comparable to upstream concentrations and lower than downstream concentrations.
- **PAHs.** Median PAH concentrations adjacent to the Site are 3 to 5 times lower than median harbor-wide values, and mean PAH concentrations adjacent to the Site are 2 to 3 orders of magnitude lower than mean harbor-wide values. Mean and median PAH concentrations adjacent to the Site are lower than either upstream or downstream concentrations.
- **Other SVOCs.** Mean and median concentrations of dibenzofuran and the phthalate compounds adjacent to the Site are one to two orders of magnitude lower than mean and median harbor-wide values. The mean concentration of 4-methylphenol adjacent to the Site is 3 times less than the harbor-wide value, and the median concentration is similar. SVOC concentrations adjacent to the Site are similar to upstream concentrations and similar or lower than downstream concentrations.
- **PCBs.** Mean PCB concentrations adjacent to the Site are about 4 times lower than the harbor-wide values, and the median concentrations are similar. Mean and median PCB concentrations adjacent to the Site are similar or lower than upstream concentrations and significantly lower than downstream concentrations.

In general, these data indicate the Site is not a significant source of any of these COIs to the Portland Harbor. These data are discussed further in the source control screening evaluation (see Section 5.8).

4.1.2 Sediment Screening Level Comparisons

The LWG sediment samples are compared to JSCS PEC values in Table 3a. Metals are also compared to background concentrations (i.e., those derived from natural geologic formations in unimpacted areas of the Pacific Northwest).

The following observations are evident from the screening level comparison:

- **Metals.** Arsenic and chromium concentrations in river sediment adjacent to the Site are within the range of background values, and copper is just slightly above the range. Copper and zinc concentrations are well below PEC values and very close to conservative TEC values (TEC = 32 and 121 milligrams per kilogram [mg/kg], respectively; McDonald et al. 2000).
- **PAHs.** Total PAH concentrations in river sediment adjacent to the Site are well below the PEC value, and below the very conservative TEC value in all but one sample (TEC = 1,610 micrograms per kilogram (μg/kg); McDonald et al. 2000).
- **Other SVOCs.** PEC values are not available for these constituents. Sediment quality values from any data source are rare or non-existent for these constituents.
- **PCBs.** Total PCB concentrations in river sediment adjacent to the Site are well below the PEC value, and below the very conservative TEC value in a majority of samples (TEC = 60 μg/kg; McDonald et al. 2000).

In general, these data indicate the Site COIs for which screening levels are available are expected to cause little or no toxicity to aquatic life in Willamette River sediments adjacent to the Site. This was confirmed by the results of bioassay tests conducted on these sediments, as discussed in the next section. These data are also discussed further in the source control screening evaluation (see Section 5.8).

4.2 Sediment Toxicity

This section discusses the results of bioassay testing of river sediment samples obtained near the Site. LWG conducted bioassay tests on sediment samples G401, G403, and G413. In summary, none of the three samples showed any significant biological effects to *Chironomus* growth or survival or *Hyalella* survival, and therefore there is no indication that these sediments exhibit toxicity to benthic invertebrates or to the invertebrate prey base of upper level organisms such as salmonids.

Below is a brief description of the freshwater bioassay performance standards and endpoints used in the biological testing program.

- **Freshwater Amphipod Bioassay.** This bioassay measures the survival of amphipods (*Hyalella azteca*) after a 28-day exposure to the test sediment. Although this bioassay also has a growth endpoint, the growth endpoint was shown to respond primarily to the physical characteristics of the sediment (e.g., percent fines and ammonia) and to have low reliability in predicting toxicity (Windward et al. 2006); therefore, this endpoint was not included in the analysis.
- **Freshwater Midge Bioassay.** This test measures the survival and growth of the midge *Chironomus tentans* after a 10-day exposure to the test sediment.

The response of bioassay organisms exposed to the tested material representing each sediment unit is compared to the response of these organisms in control treatments, given that freshwater reference sites are not yet available in the region. The LWG in consultation with EPA established three levels of biological effects:

- "No Effects" (Level 1): Greater than 90 percent of control survival or growth
- "Low Effects" (Level 2): Greater than 80 percent of control survival or growth
- "Moderate Effects" (Level 3): Greater than 70 percent of control survival or growth

These biological effects levels (Levels 1, 2, and 3) are based on statistically significant differences between the test sediment and control sediment as well as exceedance of the minimum difference thresholds.

The three sediment samples chosen by LWG to perform bioassays appear to be representative of the full range of PAH concentrations detected across the Site. The samples selected are G401, G403, and G413. G401 is located adjacent to Conoco/Phillips property near City stormwater outfall COP-022, just past the downstream boundary of the Site, as shown on Figure 4. The test results are shown in Table 4.

***Hyalella* Bioassay**. The *Hyallella* bioassay control had an acceptable absolute mean mortality of 1.25 percent. *Hyallella* mortality in the test sediments G401, G403, and G413 is 3.75 percent, 3.75 percent, and 1.25 percent, respectively (Table 4.1). Each test response is less than 10 percent over the control mortality; therefore, the test sediments exhibited no significant biological effects at the most stringent "No Effects" level for the *Hyalella* mortality endpoint.

***Chironomus* Bioassay**. The *Chironomus* bioassay control had an acceptable absolute mean mortality of 5 percent and an acceptable growth performance greater than 0.6 mg minimum mean weight per organism. Table 4.2 shows that each of the test sediments had less than 10 percent mortality over the control mortality and therefore the test sediments exhibited no significant biological effects at the most stringent "No Effects" level for the *Chironomus* mortality endpoint. Table 4.3 shows that each of the test sediments had less than 10 percent reduction in growth over the control sediment, and therefore the test sediments exhibited no significant biological effects at the most stringent "No Effects" level for the *Chironomus* growth endpoint.

4.3 Tissue Contaminant Residues in Biological Organisms

This section discusses the chemical analytical results of tissue samples from organisms obtained near the Site and from laboratory bioaccumulation test species exposed to sediments obtained near the Site.

The tissue testing program conducted by LWG included the following samples:

- **Round 1 Tissue Data.** In situ crayfish and sculpin samples were collected from the banks of the Willamette River in August through November 2002 (Integral 2004). Clam samples (*Corbicula* sp.) were also collected from a limited group of stations (07R006 and 07R003).
- **Round 2 Tissue and Bioaccumulation Test Data.** In December 2005 through March 2006, tissue samples from both in situ organisms and laboratory bioaccumulation tests were analyzed. In general, this phase of testing was focused on obtaining larger tissue volumes and achieving better analytical detection limits. In situ samples of the clam *Corbicula* sp. were collected and analyzed. Bioaccumulation tests (28-day

tests) were conducted on a freshwater oligochaete worm (*Lumbriculus variegates*) and a clam (*Corbicula fluminea*) (Integral 2006).

Samples on the west bank of the river between approximately RM-6 and RM-9 were evaluated for spatial trends in tissue residue concentrations. The following LWG Round 1 tissue sampling locations were evaluated, from upstream to downstream:

- 09R003 (up)
- 08R001 (up)
- 08R002 (adjacent)
- 07R003 (down)
- 07R006 (down)
- 06R004 (down)
- 06R001 (down)

The following LWG Round 2 tissue sampling locations were evaluated, from upstream to downstream (FC = field clam, BT = collocated bioaccumulation test for worm and clam):

- BT028/ FC028 (up)
- BT025/ FC025 (up)
- BT024/ FC024 (up)
- BT021/ FC021 (adjacent)
- BT020/ FC020 (down)
- BT018/ FC018 (down)
- BT017/ FC017 (down)
- BT015/ FC015 (down)
- BT014/ FC014 (down)

Tissue sample location maps are provided in Appendix B.

The LWG tissue samples were tested for a wide range of analytes. Analytical results for the key COIs at the Site are summarized in Table 3B, including PAHs (LPAHs and HPAHs) and metals (arsenic, chromium, copper, and zinc). Although PCBs are not a Site COI, tissue concentrations of coplanar PCB congeners are summarized because PCBs are a key bioaccumulative contaminant of concern (BCOC) for the Portland Harbor. Graphs of miscellaneous SVOCs (e.g., 4-methylphenol and representative phthalates) are provided in Appendix B but are not discussed further because these constituents are considered a low priority for bioaccumulation potential (Hoffman 2003; Corps et al. 2006; DEQ 2007).

4.3.1 Downstream Trends in Tissue Concentration

A statistical comparison of upstream, adjacent, and downstream tissue concentrations in Willamette River organisms as well as laboratory organisms cultured in Willamette River sediments is summarized in Table 3B. Harbor-wide mean and 95th percentile tissue concentrations are also provided. Spatial plots of tissue concentrations by river mile showing downstream trends in tissue quality, from upstream to downstream of the Site, are provided in Appendix B.

The following observations are evident from a spatial analysis of the tissue quality data:

- **Metals.** Tissue concentrations for metals adjacent to the Site are generally not differentiable (e.g. plus or minus 50 percent) from tissue concentrations upstream or downstream of the Site. Tissue metals concentrations adjacent to the Site are also similar to Harbor-wide mean values and do not show any evidence of unusual enrichment.
- **PAHs.** In the Round 2 data, mean PAH concentrations (LPAHs and HPAHs) in tissue samples or bioaccumulation test samples adjacent to the Site are approximately two to twenty times lower than upstream tissue samples. Somewhat smaller differences are evident in the Round 1 data.
- **PCBs.** Mean PCB concentrations adjacent to the Site are consistently lower than upstream values (about 1 to 10 times lower), as well as harbor-wide mean concentrations (about 2 to 5 times lower).

In general, these data indicate the Site is not a significant source of any of these COIs to tissue residues in Portland Harbor organisms. These data are discussed further in the source control screening evaluation (see Section 5.8).

5 MCCALL RISK SCREENING EVALUATION

In this section, a multi-step risk screening evaluation is conducted to assess whether Site stormwater, storm sediment, and groundwater are protective of the Willamette River. The risk screening evaluation considers direct effects to aquatic organisms in the Willamette River, the potential for bioaccumulative effects to humans and upper-level wildlife species that consume fish and shellfish from the river, and as a drinking water resource. The Site RI Report (Anchor 2008) also includes a risk screening evaluation of soil and groundwater data for protection of upland Site workers via soil and groundwater contact, inhalation of dust and volatiles, and related upland exposure pathways. Because those pathways are not directly related to the beneficial uses of the Willamette River, they are not included in this report.

5.1 Risk Screening Evaluation Process

The risk screening evaluation consists of the following steps, following the sequential logic of the decision-making flow chart provided in DEQ's *Guidance for Evaluating the Stormwater Pathway at Upland Sites* (DEQ 2009; Figure 2).

- **Step 1 – Comparison to SLVs.** Stormwater, groundwater, catch basin sediment, and bank surface soils are compared to SLVs for protection of ecological receptors (invertebrates, fish, and wildlife) and human health via fish consumption and drinking water (see Tables 5, 6, and 7).
  - **Step 1A. Comparison to Willamette River Background Levels.** Concentrations of COIs below the range of background concentrations in the Pacific Northwest (DEQ 2002; WDOE 1994) are not considered further.
  - **Step 1B. Comparison to Ecological SLVs.** Concentrations of COIs that are below levels considered protective of aquatic life in the Willamette River are not considered further for ecological risk.
  - **Step 1C – Comparison to Human Health SLVs.** Concentrations of COIs that are below levels considered protective of human health are not considered further for human health risk. Possible human health exposure pathways are drinking water and fish ingestion. Human health SLVs are based on large-scale and long-term exposure scenarios that are significantly averaged over space (e.g., home range of fish, harvesting area of fishermen, capture zone of a water intake system) and time (e.g., cancer risk assumes 70-year exposure period). Therefore,

human health SLVs are evaluated on the basis of site-wide average concentrations to account for the spatial and temporal averaging inherent in these types of exposures, consistent with agency guidance (EPA 1991, EPA 2006).

- **Step 2 – Evaluation of SCM Effectiveness.** MOCC's stormwater SCMs will be described and their effectiveness will be evaluated using regression analysis of NPDES monitoring data to identify trends of reducing concentrations over time (see Table 8 and Appendix B).
- **Step 3 – Comparison with Data from Comparable Sites.** MOCC's stormwater and catch basin sediment data will be compared to data from other industrial sites in the Portland Harbor (see Tables 9 and 10). The environmental quality of the MOCC storm drain system relative to what typically runs off similar industrial lands in the Portland area will be considered in the weight-of-evidence analysis.
- **Step 4 – Review Evidence of Impacts to Willamette River.** Sediment quality and tissue quality data collected upstream, downstream, and adjacent to the Site will be evaluated for evidence of Site impacts to the Willamette River and potential linkages with Site COIs and transport pathways (see Table 3). The results of the Round 1 and Round 2 sampling events by the Lower Willamette Group are used in this analysis.

An overview of the risk screening evaluation for the Site is provided in Table 11.

The SLVs used in Step 1 of the risk screening evaluation are taken from Table 3-1 of the Portland Harbor JSCS (DEQ and EPA 2007 version). The JSCS criteria for water are derived from these primary data sources:

- **Aquatic Life Criteria**
  - EPA 2006 National Recommended Water Quality Criteria (NRWQC)
  - DEQ 2004 Ambient Water Quality Criteria (AWQC)
- **Drinking Water Criteria**
  - EPA Maximum Contaminant Levels (MCL) for Drinking Water
  - EPA Region 6 Preliminary Remediation Goals (PRG) for Tap Water
- **Fish Consumption Criteria** (via Bioaccumulation)
  - EPA 2006 National Recommended Water Quality Criteria (NRWQC)

The JSCS criteria for solids (catch basin sediments and bank soils) are derived from these primary data sources:

- **Aquatic Life Criteria.** McDonald et al. 2000 PECs
- **Fish Consumption Criteria.** DEQ 2007 Bioaccumulative Sediment SLVs

In some cases, however, a lower tier of less reliable criteria were included in the JSCS and should be given less weight in the risk screening evaluation. In some cases, SLVs may have been derived from less rigorous data sets (e.g. Oak Ridge Tier 2 "secondary" values), outdated studies, and studies without peer review. In other cases SLVs may be inconsistently applied or contradictory between programs. In the following discussion, we will note particular instances where we believe the weight of the SLVs in the risk screening evaluation should be diminished based on these types of technical deficiencies.

5.2 Step 1 – Stormwater Comparison to SLVs

Table 5 provides a comparison of MOCC stormwater data with SLVs for protection of aquatic organisms and human health (fish consumption and drinking water). Stormwater was sampled at four locations (S-1 through S-4) between December 2000 and November 2007 (see Figure 4 and Appendix A). Catch basins S-1 and S-2 drain the parking area on the south side of the Brenntag facility. Catch basin S-3 receives stormwater from the northeastern portions of the Brenntag facility. Location S-4 is the oil-water separator that receives water from the MOCC terminal.

5.2.1 Metals

As an initial screen, SLVs for metals are compared to analytical results for both "dissolved" and "total" fractions (i.e., "total" fraction includes suspended sediment), even though ambient water quality criteria are regulated on a dissolved basis. The relative distribution of the stormwater contaminant load between the total and the dissolved (and more bioavailable) fraction is therefore considered in the weight-of-evidence analysis.

The results of the risk screening analysis for metals in stormwater are summarized below and in Table 11:

- **(1A) Background Screen.** Arsenic, chromium, and silver are within the range of naturally occurring background concentrations. Over 90 percent of the analytical results for cadmium, manganese, and nickel are also within the range of background concentrations. Each of these data sets contains a single result that is slightly elevated above the background value (by 10 to 25 percent, and only in the "total" fraction) but these results are nevertheless consistent with the statistical basis for the background value (i.e., background is established at the 90^{th} percentile, which leaves a 10 percent probability of exceedance; DEQ 2002; WDOE 1994).
- **(1B) Ecological Screen.** Copper and zinc concentrations in Site stormwater are commonly above background and the aquatic life SLVs, in both the total and dissolved fractions; both metals are carried forward for further analysis. In about 10 percent of the results (three out of 31 samples), lead concentrations were above background and the aquatic life SLV. Although all three lead exceedances were from the total fraction, and in all cases the dissolved concentrations were more than an order of magnitude lower (about 20 to 60 times lower), lead will be carried forward as well.
- **(1C) Human Health Screen.** Although a few individual lead results (three out of 31 samples) were above the drinking water criterion, the Site-wide average lead concentration (8.5 μg/L) is below both background (13 μg/L) and the drinking water criterion (15 μg/L) and will not be considered further. No other metals pose a concern for human health risk.
- **Summary.** Copper, lead, and zinc are carried forward for further evaluation on the basis of ecological risk.

5.2.2 Organics

The screening of organic COIs in Site stormwater includes the following modifications to the JSCS criteria:

- Aquatic life criteria for PAHs are taken from EPA 2003. DEQ has agreed to the use of the EPA 2003 criteria on an interim basis (see page 5 of the agency's comment letter dated April 30, 2008).
- The JSCS extrapolated the drinking water maximum cleanup level (MCL) for benzo(a)pyrene to all of the light and heavy priority pollutant PAHs. We do not

believe it is appropriate to indiscriminately assign the benzo(a)pyrene criterion to non-carcinogenic PAHs with toxicities many orders of magnitude lower, and we have therefore limited the application of this criterion to the listed carcinogenic PAHs.

The results of the risk screening analysis for organics in stormwater are summarized below and in Table 11:

- **(1A) Detection Limit Screen.** PCBs are not detected in any stormwater samples and are not considered further.
- **(1B) Ecological Screen.** None of the PAHs exceeded their aquatic life criteria. None of the phthalates or other semivolatile compounds exceeded their aquatic life criteria, with one exception. In one sample (S-2 on 11/12/07), bis(2-ethylhexyl)phthalate (DEHP) exceeded the DEQ ambient water quality guidance value from OAR Table 33C for the non-specific "phthalate esters" group. However, the National Recommended Water Quality Criteria (NRWQC) states: "There is a full set of aquatic life toxicity data that show DEHP is not toxic to aquatic organisms at or below its solubility limit" (see EPA 2006, Footnote X). By complying with the NPDES permit limit for oil and grease, it is assumed that petroleum compounds are not causing adverse impacts on the river.
- **(1C) Human Health Screen.** LPAHs and noncarcinogenic HPAHs were four to six orders of magnitude lower than their fish consumption criteria. Site-wide average concentrations of several carcinogenic HPAHs were above the fish consumption criteria and will be carried forward in the screening evaluation. However, all carcinogenic HPAHs were below the drinking water criterion. Although a few individual DEHP results (two out of seven samples) were above the fish consumption and/or drinking water criterion, the Site-wide average DEHP concentration (1.8 μg/L) is below both criteria.
- **Summary.** HPAHs are carried forward in the screening evaluation based on exceedances of the fish consumption criteria in several samples. DEHP and LPAHs are carried forward for informational purposes and to build a stronger weight of evidence that these COIs are adequately controlled.

5.3 Step 1 – Groundwater Comparison to SLVs

Table 6 provides a comparison of Site groundwater data from shoreline monitoring wells with SLVs for protection of aquatic organisms and human health (fish consumption and drinking water). Shoreline monitoring wells include EX-2, EX-3, EX-5, MW-5, MW-7, MW-8, and MW-14. These wells were sampled during several groundwater monitoring events between December 2000 and October 2004.

5.3.1 Metals

As an initial screen, SLVs for metals are compared to analytical results for both "dissolved" and "total" fractions (i.e., "total" fraction includes suspended sediment), even though ambient water quality criteria are regulated on a dissolved basis. The relative distribution of the stormwater contaminant load between the total and the dissolved (and more bioavailable) fraction is therefore considered in the weight-of-evidence analysis.

The results of the risk screening analysis for metals in groundwater are summarized below and in Table 11:

- **(1A) Background Screen.** All three of the metals analyzed in groundwater (arsenic, chromium, and copper), are above background levels in multiple samples.
- **(1B) Ecological Screen.** Total chromium and total copper are above their dissolved aquatic life criteria in two and four samples, respectively. All of the exceedances are restricted to the total fraction in wells MW-7 and MW-8, with dissolved concentrations being one to two orders of magnitude lower. Soil disturbance during the installation of monitoring wells MW-7 and MW-8 is the suspected cause of the exceedances, as they only occurred within six months of installation. Concentrations of these metals have since dropped by approximately two orders of magnitude, and are currently below background concentrations.
- **(1C) Human Health Screen.** Arsenic exceeds its fish consumption criterion in a majority of samples, and its drinking water criterion in several samples, in both total and dissolved phases. Chromium exceeds its drinking water criterion in

two samples, but the exceedances are believed to be caused by excess sediment in monitoring wells MW-7 and MW-8 following installation (see above).

- **Summary.** No metals in groundwater are carried forward on the basis of ecological risk. Arsenic will be evaluated further based on exceedances of human health criteria.

5.3.2 Organics

The results of the risk screening analysis for organics in groundwater are summarized below and in Table 11:

- **(1A) Detection Limit Screen.** There were no detections of di-n-octyl phthalate, and very few detections of butyl benzyl phthalate and dibenzofuran (two out of 31 samples, each one). Only four VOCs were detected in any of the shoreline monitoring wells. Only these four VOCs (listed in Table 6) were subjected to the risk screening evaluation.
- **(1B) Ecological Screen.** Carbon disulfide (a VOC) exceeded the Oak Ridge National Laboratory's Tier 2 secondary chronic value (Suter and Tsao 1996) in only one out of 26 samples, at a relatively low level (approximately 50 percent above the SLV). This chemical is not considered further. No other organic COIs (PAHs, phthalates, or other VOCs) exceeded their aquatic life criteria.
- **(1C) Human Health Screen.** No LPAHs or miscellaneous semivolatile compounds were above human health SLVs. Carcinogenic PAHs were above fish consumption criteria in four out of 30 samples and above drinking water criteria in one out of 30 samples; Site-wide average concentrations for five carcinogenic PAHs were slightly above fish consumption criteria but all were below drinking water criteria. Vinyl chloride was detected in approximately 10 percent of the samples (three out of 28 samples) at concentrations above the Tap Water preliminary remediation goal (PRG), but below the MCL. Because these few detections of vinyl chloride are in compliance with national drinking water standards, as well as fish consumption criteria, they will not be considered further.
- **Summary.** No organic COIs are carried forward in shoreline groundwater on the basis of ecological risk. Carcinogenic PAHs will be evaluated further based on occasional exceedances of human health criteria in a few samples.

5.4 Step 1 – Catch Basin Sediment Comparison to SLVs

Table 7 provides a comparison of MOCC catch basin sediment data with SLVs for protection of aquatic organisms and human health (fish consumption and drinking water). As discussed below, a number of metals and organic COIs exceed their respective SLVs in catch basin sediment samples. However, the extremely conservative nature of this type of comparison must be emphasized. While catch basin sediments are evaluated using freshwater sediment criteria, aquatic organisms do not live in storm drains, and catch basins are not a relevant point of exposure. Furthermore, catch basins and filter inserts are designed to trap sediments and remove them from the storm drain system. As a result, samples collected from these devices may not be representative of the pollutants that are actually being transported to the river.

5.4.1 Metals

The results of the risk screening analysis for metals in catch basin sediment is summarized below and in Table 11:

- **Background Screen.** Manganese and silver are below background levels and will not be considered further.
- **Ecological Screen.** In addition to manganese and silver, cadmium and mercury did not exceed their ecological SLVs (PECs and related criteria) in any sample. All other metals (arsenic, chromium, copper, lead, nickel, and zinc) were above ecological SLVs in at least one catch basin sample.
- **Human Health Screen.** Arsenic, cadmium, lead, and mercury exceeded the DEQ bioaccumulation SLVs in all or a majority of the samples.
- **Summary.** All metals except manganese and silver will be carried forward for further evaluation based on exceedances of ecological SLVs, human health SLVs, or both.

5.4.2 Organics

The results of the risk screening analysis for organics in catch basin sediment are summarized below and in Table 11:

- **(1A) Detection Limit Screen.** Low molecular weight phthalates (dimethyl phthalate and diethyl phthalate) were not detected in catch basin sediment.

- **(1B) Ecological Screen.** Concentrations of several HPAHs are above their ecological criteria in several samples. LPAH criteria were also exceeded, but fewer compounds and fewer samples were affected. No phthalates or PCBs were above their ecological criteria.
- **(1C) Human Health Screen.** The DEQ bioaccumulative SLV for PCBs was exceeded in all catch basin sediment samples. Although a few samples were above the DEQ bioaccumlative SLV for pyrene, the site-wide average concentration was below the SLV. Bioaccumulative SLVs for di-n-butyl-phthalate and bis(2-ethylhexyl) phthalate were also exceeded; however, the phthalate bioaccumulative SLVs are derived from an older DEQ guidance document that was not subjected to peer review, and these SLVs were not brought forward in DEQ's 2007 bioaccumulation guidance. Recent work by the multi-agency Regional Sediment Evaluation Team (RSET) classifies these phthalates as a low priority ("Level 3") for bioaccumulation concern (Corps et al. 2006).
- **Summary.** LPAHs and HPAHs will be carried forward based on exceedances of ecological criteria. PCBs will be carried forward based on exceedances of human health criteria. Higher molecular weight phthalates (i.e., those with detected concentrations in the catch basins) will be retained in spite of a less reliable basis for the bioaccumulative SLVs for these compounds.

5.5 Step 1 – Bank Soil Comparison to SLVs

Table 7 provides a comparison of river bank surface soil data with SLVs for protection of aquatic organisms and human health (fish consumption and drinking water). The surface soils on the river bank of the Site represent soil that could erode or slough directly into the river.

No river bank soil samples exceeded any of the ecological or human health screening criteria for any COIs. As a result, this is an insignificant exposure pathway and will not be considered further.

5.6 Step 2 – Evaluation of SCM Effectiveness

MOCC has implemented a number of stormwater SCMs, as described in this section. The effectiveness of the SCMs will be evaluated using time-series charts of NPDES monitoring data to identify trends of reducing concentrations over time (see Table 8 and Appendix B).

5.6.1 Description of Source Control Measures (SCMs)

Following is a list of SCMs that are being implemented at the Site to help control stormwater quality:

- **Catch Basin Cleaning.** MOCC conducts annual cleaning of all stormwater catch basins on the Site, including those located on the Brenntag facility.
- **Inlet Protection.** Catch basins are protected with bio bags and fabric filter inserts to reduce the sediment load to the storm drain. Note that catch basin sediment samples S-1 and S-2, as described in Section 5.4, are typically collected from retained solids that did not pass through the filter.
- **Retrofit of Catch Basin S-3.** Catch basin S-3, with emergency shut-off valve, was retrofitted in Fourth Quarter 2005 to accept filter fabrics, as shown in the photo on Figure 5.
- **Monitoring of Oil-Water Separator.** MOCC monitors the effluent flows from the oil-water separator at sampling location S-4 (see Figure 4). MOCC also collects discrete samples under a NPDES 1200Z permit .

5.6.2 Analysis of Stormwater Quality Trends

More than a decade of NPDES monitoring data (from 1995 to the present) were analyzed to identify trends in contaminant concentrations, in particular, reducing trends that would indicate MOCC's SCMs are having a beneficial effect on stormwater quality. A least-squares regression analysis was performed on the logarithms of the data (assuming an approximate lognormal distribution), which is the equivalent of an exponential decay function. Standard regression statistics were used to determine if the slope of the regression line was significantly different from zero (i.e., the null hypothesis is there is no change in stormwater quality over time). If a significant reducing trend was observed for a particular pollutant, the percent reduction in concentration in 10 years time was calculated. Time trend plots are compiled in Appendix C.

The results of the regression analysis are summarized below and in Table 8:

- **Total Suspended Solids (TSS).** Reducing trends in TSS concentrations at stations S-1 and S-3 were determined to be statistically significant. In a 10- year period, TSS percent reductions of 69 to 76 percent were estimated.
- **Metals.** Reducing trends in copper concentrations at station S-3, and reducing trends in lead concentrations at stations S-1 and S-3 were determined to be statistically significant. In a 10-year period, percent reductions of 64 to 84 percent were estimated for copper, and better than 90 percent reduction for lead at both stations. In addition, reducing trends in zinc were significant at a slightly reduced confidence level (93 to 94 percent confidence), resulting in estimated percent reductions of 49 to 54 percent.
- **Oil and Grease.** Although time trends in oil and grease concentrations were not statistically significant, a qualitative inspection of the time series plot indicates some improvement has occurred (see Appendix C). In particular, there has been a reduction in the number and magnitude of peak oil and grease concentrations. Between 1999 and 2004, there were seven reports of oil and grease concentrations between 15 and 30 mg/L, but from 2004 to the present, there have been no concentrations greater than 15 mg/L. Also, a statistically significant reducing trend in chemical oxygen demand (COD) was observed at station S-3, suggesting concentrations of organic (oxygen-demanding) substances are being controlled.

The regression analysis provides quantitative evidence that concentrations of TSS, metals, and to some degree organic constituents are decreasing over time in response to the SCMs that have been implemented at the Site. Control of TSS, in particular, is expected to provide added benefits for other contaminants that are associated with suspended sediments, such as particulate-bound metals and hydrophobic organics (e.g., HPAHs, DEHP).

5.7 Step 3 – Comparison with Data from Other Comparable Sites

Portland Harbor stormwater and storm sediment data from the LWG Round 3A and 5B sampling program is compiled in Tables 9 and 10, respectively (Anchor and Integral 2008). These data are compared to reported concentrations at the MOCC facility for COIs that were previously shown to be above relevant SLVs during the screening evaluation. The following summary statistics for heavy industrial land use sites were compiled:

- 50th Percentile Concentration (Median)
- Arithmetic Mean Concentration
- 90th Percentile Concentration

5.7.1 Stormwater Comparison

The following results are evident from inspection of Table 9.

- **Metals.** There are a few monitoring events where concentrations of dissolved cadmium, copper, or zinc are above the mean values for heavy industrial land use; however, these instances are relatively uncommon. However, the Site-wide mean concentrations for stormwater metals data at the MOCC facility are well below the corresponding mean values for Portland Harbor in every case. Typically the Site-wide mean concentration is about 10 to 50 percent of the Portland Harbor mean.
- **Organics.** In a few monitoring events (five out of 20), the concentrations of some LPAH compounds were above the Portland Harbor mean or 90th percentile values. However, the Site-wide mean concentrations for stormwater LPAH data at the MOCC facility are typically at or below the corresponding mean values for Portland Harbor, for every constituent except fluorene. The Site-wide mean concentration for HPAHs is typically an order of magnitude lower than comparable Portland Harbor sites. Site-wide mean phthalate and methylated phenol concentrations are also lower than normal for this type of land use.

In summary, comparison of MOCC stormwater data with comparable industrial sites in the Portland Harbor shows substantially lower concentrations (typically, two to ten times lower) at the MOCC Site. This provides evidence that the SCMs being implemented at the Site result in stormwater quality that is generally above the standard of practice for the Portland Harbor.

5.7.2 Catch Basin Sediment Comparison

The following results are evident from inspection of Table 10.

- **Metals.** There are a few monitoring events where catch basin sediment concentrations of arsenic, chromium, and lead are above the mean values for heavy industrial land use, but overall, Site-wide mean concentrations are at or below those typically reported for this type of land use. Site-wide mean values for arsenic, lead, and nickel are similar to those observed at other heavy industrial sites, and Site-wide mean values for all other metals are lower than normal.
- **Organics.** In general, LPAH and HPAH compounds at the Site are unusually low for heavy industrial sites in the Portland Harbor. There is one unusually elevated fluorene concentration from the first round of catch basin sampling at Station S-3, but fluorene has subsequently decreased by almost two orders of magnitude in subsequent rounds. More typically, the Site-wide mean concentrations for PAH compounds are an order of magnitude lower than those reported at comparable industrial sites. The profile of phthalate compounds at the Site appears to be somewhat unusual, with elevated concentrations of butyl benzyl phthalate and di-n-octyl phthalate. However, Site-wide concentrations of DEHP, the most toxic of the phthalates from a human health perspective, is well below average.

In summary, comparison of MOCC catch basin sediment data with comparable industrial sites in the Portland Harbor shows concentrations that are at or below those normally observed for this type of land use. In particular, concentrations of LPAH and HPAH compounds are substantially lower than the mean values for Portland Harbor, typically about 10 times lower. This provides evidence that the SCMs being implemented at the Site result in catch basin sediment quality that is generally comparable or better than the industrial standard for the Portland Harbor.

5.7.3 Groundwater Loading Analysis for Arsenic

Arsenic concentrations in Site groundwater are below aquatic life criteria, but above human health criteria based on fish consumption and drinking water (see Table 6), prompting further evaluation. This section compares arsenic concentrations and loads at the Site with those derived from naturally occurring volcanic soils in western Oregon. These natural sources contribute significant quantities of arsenic to the Willamette River via erosion, runoff, and groundwater seepage, which are then transported to the Portland Harbor at the bottom of the watershed.

Although a database of shoreline groundwater concentrations in Portland Harbor is not available, Site groundwater concentrations may be compared to a more regional U.S. Geological Survey (USGS) study of arsenic concentrations in Willamette Valley groundwater (USGS 1999). Willamette Valley groundwater has anomalously high arsenic concentrations, routinely above the drinking water MCL of 10 μg/L; the 78th percentile arsenic concentration is 10 μg/L and the 92nd percentile arsenic concentration is 50 μg/L. Site groundwater concentrations in some monitoring wells (EX-2 and EX-3, in particular, which range from 57 to 90 μg/L) are higher than the 90th percentile concentration for the Willamette Valley.

To further assess the impact that Site groundwater discharges may have on the Willamette River, a mass loading analysis was conducted. The annual mass load of arsenic was calculated for Site groundwater discharges and compared to the annual mass load contributed from background arsenic concentrations in transport down the Willamette River.

The inputs to the mass loading analysis include the following:

- **MOCC Groundwater Discharge Volume.** The mean groundwater gradient in the shoreline area of the Site is 0.025 (range from 0.01 to 0.05) and the geometric mean hydraulic conductivity is 0.013 feet/minute (range from 0.003 to 0.16 feet/minute). The length of the shoreline is approximately 1,500 feet and the saturated thickness of the shallow water-bearing zone (i.e., in the fill sands overlying native alluvium) is approximately 10 feet.
- **Mean Annual Willamette River Discharge**. The mean annual discharge in the Willamette River from 1973 to the present is about 33,000 cfs, according to the USGS Portland gage #14211720 (http://waterdata.usgs.gov/nwis).
- **Mean Groundwater and River Concentrations.** The mean concentration of arsenic in Site groundwater is 26 μg/L (see Table 6), and the background concentration in the Willamette River is 2 μg/L (DEQ 2002).

The volumetric flux from each source (in volume/time, e.g., cfs) times the mean concentration of each source (in mass/volume, e.g., μg/L), with appropriate conversion factors, yields the mass load (in mass/time, e.g. kg/yr). The calculated mass load of arsenic in transport down the Willamette River is 59,000 kg/yr, and the mass load of arsenic from Site groundwater discharges is 1.9 kg/yr. Site groundwater contributes about 0.003 percent of the background load for arsenic, a negligible contribution to the arsenic budget in the river.

5.8 Step 4 – Evaluation of Site-Related Impacts to the Willamette River

The statistics and data plots compiled in Tables 3a, 3b, and Appendix B provide a summary of sediment quality and tissue quality data in Portland Harbor upstream, downstream, and adjacent to the Site for a representative list of COIs. Sediment and tissue sample locations are shown in Figure 4 and Appendix B. The spatial distribution patterns of these COIs in the river is analyzed for evidence of correlations that may suggest a pathway linking Site sources and COIs to adjacent impacts in the river. The following observations are derived from this analysis:

- **Metals.** Arsenic and chromium concentrations in river sediment adjacent to the Site are within the range of background values, and copper is just slightly above the range. Copper and zinc concentrations are well below PEC values and very close to conservative TEC values (TEC = 32 and 121 mg/kg, respectively; McDonald et al. 2000). Metals concentrations adjacent to the Site are not differentiable from upstream concentrations.
- **PAHs.** Total PAH concentrations in river sediment adjacent to the Site are well below the PEC value, and below the very conservative TEC value in all but one sample (TEC = 1,610 μg/kg; McDonald et al. 2000). PAH concentrations adjacent to the Site are also lower than concentrations observed both upstream and downstream of the Site.
- **PCBs.** Total PCB concentrations in river sediment adjacent to the Site are well below the PEC value, and below the very conservative TEC value in a majority of samples (TEC = 60 μg/kg; McDonald et al. 2000). Total PCB concentrations adjacent to the Site are also lower than concentrations observed both upstream and downstream of the Site.

- **Other Constituents.** Other SVOCs (dibenzofuran, 4-methylphenol, and two phthalates) exhibit similar spatial distribution patterns. In general, there is no evidence that Site sources have resulted in any anomalous enrichments of these chemicals in the adjacent river, relative to upstream and downstream concentrations. PEC values are not available for these constituents.
- **Sediment Sample S3-01C.** River sediment sample S3-01C was collected at low water level just below the outfall for the S-3 storm drain (see Figure 4 and Table 7). All metals were within the range of background concentrations, and all other constituents were orders of magnitude below ecological and human health screening levels. Thus, there is no evidence that discharges from outfall S-3 have impacted the river.
- **Bioassays.** A suite of three bioassay tests were conducted at three sampling stations adjacent to the Site (G401, G403, G413; see Tables 3 and 4). All tests showed no effects on benthic organisms at all three stations.
- **Tissue Contaminant Residues.** Contaminant residue concentrations in the tissues of river organisms and laboratory bioaccumulation test organisms show that metals concentrations adjacent to the Site are similar to upstream concentrations and harbor-wide mean values, while the concentrations of organic contaminants (PAHs and PCBs) adjacent to the Site are consistently lower than upstream concentrations and harbor-wide mean values (see Table 3b).

In summary, in consideration of sediment quality SLVs, combined with the spatial distribution patterns of sediment and tissue concentrations upstream, downstream, and adjacent to the Site, there is no evidence that sediment quality or tissue contaminant residues in the river have been impacted by current or historical discharges from the Site.

6 SUMMARY OF RISK SCREENING EVALUATION

A summary of the relevant decisions and conclusions of the risk screening evaluation and pathway analysis is provided below.

6.1 Step 1 – Comparison to SLVs

6.1.1 Stormwater

Copper, lead, and zinc were carried forward for further evaluation on the basis of ecological risk. HPAHs were carried forward based on exceedances of fish consumption criteria in several samples.

6.1.2 Groundwater

No metals in groundwater were carried forward on the basis of ecological risk. However, arsenic was evaluated further based on exceedances of human health criteria (fish consumption and drinking water). Carcinogenic PAHs were carried forward based on occasional exceedances of human health criteria.

6.1.3 Catch Basin Sediment

All metals except manganese and silver were carried forward for further evaluation based on exceedances of ecological SLVs, human health SLVs, or both. LPAHs and HPAHs were carried forward based on exceedances of ecological criteria, and PCBs based on exceedances of human health criteria.

6.1.4 Bank Surface Sediment

No river bank soil samples exceeded any of the ecological or human health screening criteria for any COIs. As a result, this was determined to be an insignificant exposure pathway and was not considered further.

6.2 Step 2 – Evaluation of SCM Effectiveness

Over 10 years of NPDES monitoring data was statistically analyzed using least-squares regression techniques. This analysis provides quantitative evidence that concentrations of TSS, metals, and to some degree organic constituents (i.e. COD, as well as diminishing peak concentrations of oil and grease) are decreasing over time in response to the SCMs that have been implemented at the Site. Control of TSS is expected to provide added benefits for other contaminants that are associated with suspended sediments, such as particulate-bound metals and hydrophobic organics (e.g., HPAHs, DEHP, etc.).

6.3 Step 3 – Comparison with Data from Other Comparable Sites

Comparison of Site stormwater data with comparable industrial sites in the Portland Harbor shows substantially lower concentrations (i.e., two to ten times lower) at the Site compared to those typically observed for this land use. Similarly, catch basin sediment data at the Site is generally at or below concentrations from other industrial sites. These comparisons provide evidence that the SCMs being implemented at the Site result in stormwater and storm sediment quality that is generally comparable or better than the industrial standard for the Portland Harbor.

6.4 Step 4 – Evaluation of Site-Related Impacts to the Willamette River

Sediment concentrations of COIs in the Willamette River adjacent to the Site are well below PEC values and in many cases near or below TEC values and background concentrations. Bioassay tests at three locations showed no effects on benthic organisms. Sediment concentrations adjacent to the Site are similar or lower than those observed at locations directly upstream. Similarly, contaminant residue concentrations in the tissues of river organisms and laboratory bioaccumulation test organisms show that metals concentrations adjacent to the Site are similar to upstream concentrations and harbor-wide mean values, while the concentrations of organic contaminants (PAHs and PCBs) adjacent to the Site are consistently lower than upstream concentrations and harbor-wide mean values. In combination, these observations provide a consistent weight of evidence that current or historical discharges from the Site have not caused any substantive impacts to sediment quality or tissue contaminant residues in the river.

6.5 Summary

In summary, the weight of evidence established during the source control screening evaluation shows that SCMs have been effective at reducing contaminant loads from the Site. Site stormwater quality is better than average for heavy industrial land use, there is no evidence of impacts to Willamette River sediments or tissue residues from Site discharges, and in general, source control is in place at this facility. Furthermore, MOCC's NPDES stormwater permit will ensure that source controls remain functional and effective in the foreseeable future. Therefore, we respectfully request that DEQ issue a favorable Stormwater Source Control Decision for this Site.

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TABLES

Table 1
McCall Oil & Chemical Corporation
Summary of Historical Spill Releases – McCall

Spill No.	Dates	Material Released	Location	
1	1955-80	Medium cure (MC) products (containing kerosene distillates); Rapid cure (RC) products (containing petroleum naphthalene); stove oil; all used to manufacture asphalt cold-patch.	Douglas Asphalt Plant	Approximately 4 or 5 spill incidents involving 4,000 to 10,000 gallons per incident occurred in this area prior to the construction of the lube oil tank farm in 1982. Typically, the spilled product was recovered to the extent practicable, and the waste materials would be collected in 55-gallon metal drums and sent to St. John's Landfill.
2	Mid-1960's	MC-250; MC-products contain kerosene distillates; MC-250 is 25% stove oil and 75% paving-grade asphalt.	Douglas Asphalt Plant	Operator error during the routine transfer of MC-250 resulted in the release of approximately 8,000 to 10,000 gallons of MC-250 into the aboveground storage tank containment area at the Douglas MC plant. The MC-250 remained a homogeneous mixture as it quickly cooled and hardened. The usable material was recovered using jackhammers and shovels. Unusable spilled material was sent to the St. John's Landfill.
3	Mid-1970's	Oil and water	Marine Terminal Slop Tank	The slop tank valve was inadvertently left open and an unknown quantity of oil and water was released into the Willamette River.
4	1982	Lube oil	McCall Lube Oil Plant	The lube oil plant was constructed in 1982. During construction, a lube oil spill occurred resulting in the release of an unknown quantity of lube oil into the aboveground storage tank area. Lube oil was recovered to the extent practical using a vacuum truck.
5	1955-80	Re-refined oil	Marine Terminal Tanks 10 and 7	The re-refined oil line between tanks 7 and 10 in the McCall Terminal leaked as a hose was disconnected from a product-transfer truck, resulting in the release of a small quantity (<25 gallons) of oil onto the surrounding soil. All visibly stained soil was excavated and disposed in an off-site landfill. The oil was nearly solid at ambient temperature.

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Spill No.	Dates	Material Released	Location	
	Mid-1970's	Asphalt	Marine Dock	
7	Early-1980's	Bunker Fuel	Marine Terminal Tank 6	The bunker fuel tank (Tank 6) at the McCall Terminal was overfilled, resulting in the release of approximately 100 gallons of bunker fuel onto the surrounding soil. The spill was immediately cleaned up and all visibly stained soil was excavated and disposed at Hillsboro landfill.
8	1984	Bunker Fuel (#6 fuel oil, marine fuel or industrial fuel oil)	Asphalt Plant Tank 20	Approximately 800 barrels of bunker fuel was released at the McCall asphalt plant due to a tank manhole cover left open during tank filling operations. The Oregon DEQ was notified and cleanup operation were conducted by Environmental Pacific.
9	1985	Caustic soda	Asphalt Plant	Tanker truck at the former loading rack (currently the asphalt loading rack) contained caustic soda. Tanker truck overfill resulted in the release of approximately 60 gallons of caustic soda.
10	1989	Oil and water	Marine Terminal Slop Tank	The contents of the slop tank overflowed and an unknown quantity of oil and water was released onto the ground. Visibly impacted soils were removed immediately following the incident.
11	1989	Asphalt	Asphalt Plant Tank 24	Approximately 200 gallons of asphalt were inadvertently released from Tank 24. The spilled asphalt was collected using jackhammers and shovels and disposed of at an off-site landfill. Cleanup conducted by NW Field Services.
12	Unknown	Asphalt flux	Flintkote	Small shipments (i.e., 1-2 truckloads) of asphalt flux overfilled on several occasions. The quantity is estimated to be small, but occurred periodically. The material was cleaned up following each incident.
13	1991	Asphalt	Marine Dock	A hose barge burst during asphalt loading operations at the new marine dock resulting in the release of an unknown quantity of asphalt into the river.
14	1983	Water and emulsified asphalt	Marine Terminal	Emulsified asphalt was sprayed onto the soil berm surrounding the aboveground storage tank farm at the McCall Oil terminal to prevent berm erosion. Following the

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Spill No.	Dates	Material Released	Location	
				application of asphalt, rain ensued prior to the asphalt hardening, resulting in storm water discharge containing trace amounts of asphalt.
15	1991	Bunker Fuel	Asphalt Plant Railcar Loading Area	A railcar tank bleeder-valve handle was inadvertently opened during product transfer operations and approximately 20 gallons of bunker fuel was released onto the surrounding soil during a period of heavy rainfall. Absorbent pads were immediately placed on the standing water and soil impacted with bunker fuel. No subsequent soil excavation was required.
16	1975-82	Oil and Water	Marine Terminal Slop Tank	Two separate spills of diesel fuel from slop Tank 12 occurred during this period. Approximately 50 gallons of oil and water were released during each incident. While skimming the oil water separator, the operator left the skimmer unattended and overfilled a tank.
17	10/13/98	Diesel Fuel	Oil Water Separator	Oil and water Spill OERS No. 98-2471. Temporary blockage of outlet for new separator resulted in light sheen on river. Estimate less than 2 gallons of diesel.
18	11/19/99	Bunker Fuel	Rail tank car	Rail tank car overflow during offloading. Foss Environmental removed 11 drums soil and ballast. Estimated 85 gallons released.
Spill No.	Dates	Material Released	Location	
19	7/16/95	RFO Bunker Blend	Marine Terminal	A flange gasket cracked and split, allowing oil to seep by it under the pressure of the positive displacement pump. Estimated 50 gallons released and recovered.
20	1/12/90	Reclaimer motor oil	Lube tank farm area	A camlock fitting came loose during delivery pump off. Oil absorbent applied immediately. NW Field Services vacuumed standing oil, dug out oil, stained fill/absorbent. Estimated 200 gallons spilled onto area paved with asphalt and recovered.
21	8/10/90	Asphalt Mix Oil	Asphalt Plant/NW Front Avenue	Spill occurred as customer truck departed the facility. Product drained into storm drain on Front Avenue in sufficient volume to react with storm water and boil over.

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22	10/4/00	Bunker Fuel	Marine terminal near 10" flow meter	Spill occurred when the casing of a 10" flow meter failed. Pipeline pressure caused 250 to 300 gallons to spray on the ground near meter. Foss Environmental vacuum removed five 55 gallon drums of oil. Approximately 7.5 tons contaminated soil was removed and placed in a drop box for landfill disposal .
23	10/1/05	Asphalt Flux	Asphalt Plant	Approximately 300 gallons of asphalt flux was spilled to a failed gasket on a flange. Spill was contained and recovered.
24	8/7/06	Diesel	Marine Terminal	15 gallons of fuel was released to the water during fueling of a barge. The spill was boomed, contained, and recovered.
25	5/10/07	Asphalt	Loading Rack	Approximately 200-300 gallons of asphalt was released during truck loading operations. Spill was contained and recovered.
26	5/15/07	Diesel	Loading Rack	Approximately 200 gallons of fuel was released to the ground due to a truck overfill. Spill was contained and recovered.
27	11/06/07	Diesel	Marine Terminal	Approximately 50 gallons of fuel spilled on a tug during fueling. Booms were deployed and the release was contained and cleaned up.

Table 2
Brenntag Pacific (former site of Great Western Chemical Corporation)
Summary of Historical Spill Releases

Number	Dates	Material Released	Location	Description
1	1988 or 1989?	H_2SO_4	On blacktop (drumming area)	A drum of H_2SO_4 split open. Spill was diked and cleaned up with sorbent material.
2	?	CO630 (surfactant)	Railcar loading area	Release during tank car offloading - cleaned up.
3	?	H_2SO_4	Acid tank farm	Valve apparently left open; quantity unknown, but spill contained within bermed area.
4	1987 or 1988?	H_2SO_4	Acid tank farm	Bottom of tank corroded, approximately 20,000 gallons spilled into bermed area. Acid was pumped into trucks and tanks were repaired and raised onto pads.
5	?	Rinsate	Drum rinse area	Rinsate from acid drum rinsing operations occasionally flowed onto unpaved area..
6	?	Calgon Cat-Floc	Technical Center railcar loading area	Several incidental spills, cleaned up and put into totes.
7	1990	1,1,9-Triethylamine	Portland Branch railcar loading area	Railcar leaked over the weekend in the loading area. Soil was tested by Hahn & Associates. No further action required. No detections. Amount of spill was below the reportable quantity limit.
8	1984 (?) - 1988	$CuSO_4$	$CUSO_4$ containment structure	Crack in the concrete $CuSO_4$ containment structure was discovered during decommissioning activities. Soil was overexcavated beneath the structure and soil and concrete were disposed of off-site at Chemical Waste Management hazardous waste landfill at Arlington, Oregon.
9	1984 (?) - 1989	CCA	CCA process area	A prior release was discovered in 1992 during excavation in the former CCA Process Area. Soil and concrete were excavated and confirmation samples were collected from the excavation. Concrete and soil were disposed of off-site at Chemical Waste Management hazardous waste landfill at Arlington, Oregon. Groundwater monitoring continues.
10	1/21/99	Sodium hydroxide (caustic soda)	Storage yard	Tote bin of caustic soda fell from forklift. Contents released onto asphalt pavement drainage ditch. Spill diked and fully contained; no release to land or water. All materials cleaned up. Estimated 2,000 lbs. of combined material and absorbent material.
11	4/28/93	Diesel Fuel	Parking lot	A distributor was operating a truck and backed over a stake on the RR grade, puncturing the diesel tank. Estimated 30 gallons was spilled onto asphalt-paved parking area. All materials thoroughly cleaned up – no release to land or water.
12	3/26/96	Sulfuric acid	Acid loading rack	A driver was filling his tanker truck with no gauges, resulting in an overflow of

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Number	Dates	Material Released	Location	Description
				product. Estimated 150-200 gallons was spilled in contained area. All materials cleaned up – no release to land or water.
13	6/24/99	Sulfuric acid	GWEM receiving dock	Drum slipped from drum pick, dropping 12-18". Drum split open; 55 gallons of product splashed onto receiving dock. Spill cleaned – no release to environment.
14	5/19/99	Sulfuric acid	GWEM warehouse	Drum slipped off the drum pick while being lifted causing release of 500 gallons of product onto floor. Spill cleaned – no release to environment.
15	4/26/00	Sulfuric acid	Tank farm	Contractor dropped pipe onto valve resulting in leakage of product onto graveled area adjacent to the truck scale. Foss Environmental excavated materials and performed confirmation sampling. Estimated release of 70 gallons.
16	8/5/98	Lacquer thinner	Warehouse	Forklift pierced bottom of drum resulting in release of approximately 25 gallons of product onto warehouse floor. Product was contained and absorbed. No release to the environment.
17	9/22/98	Sodium hypochlorite	GWEM Warehouse	A tote ruptured while being moved to the trailer. Approximately 220 gallons of product was spilled. Material was contained with absorbent. No release to the environment.
18	1/7/99	pH water	Storage yard	A hose ruptured during pumpdown of one of the pH pumps. Unknown quantity ran into the asphalt trench. Drainage valves were closed – no material reached the river. Ditch was hosed down, materials were pumped into a tote and returned to remediation tank.
19	3/1/99	Lubricoat	Tech Center loading bay	Tote overturned causing release of 200 gallons of product onto paved truck area. Sewer hole was covered immediately. Material was absorbed. No release to tank or water.
20	3/21/96	Naphtha solvent	Rail tank car	A gasket leaked while unloading a railcar. Salvaged product was pumped into recovered drums. Estimated 40 lbs released and recovered.

Table 3a
Comparison of Portland Harbor Sediment Quality
Upstream, Downstream, and Adjacent to Site
Portland, Oregon

			Total LPAHs (ug/kg)	Total HPAHs (ug/kg)	Total PAHs (ug/kg)	Arsenic (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Zinc (mg/kg)	Dibenzo-furan (ug/kg)		4-Methyl-phenol (ug/kg)		Butylbenzyl phthalate (ug/kg)		Di-n-octyl phthalate (ug/kg)		Total PCBs (ug/kg)	Bioassay Result[1]
G369	7.50	Downstream	31	192	223	4.3	36	41	109	1.3		12		1.85	U	1.50	U	20	
G377	7.55		13	120	133	2.9	23	16	75	0.39		4		1.05	U	0.85	U	0.9	PASS
G374	7.60		33	218	251	4.6	35	41	110	1.2		18		5.5		1.4	U	23	
G389	7.65		1	2	3	1.9	25	16	52	0.13	U	2.2	U	1.2	U	0.9	U	2.7	CM HIT
G381	7.68		87	238	325	4.5	34	42	175	2.8		15		1.5	U	1.2	U	85	
G394	7.73		3,290	1,800	5,090	4.2	39	50	244	52		ND	U	ND	U	ND	U	703	
G401	7.79		674	3,560	4,234	4.5	30	36	140	17		15	U	7.5	U	40		36	PASS
G404	7.80	McCall	225	1,020	1,245	4.2	34	40	120	12		16		1.5	U	15		27	
C532	7.81		256	546	802	5.0	37	54	170	8.5		110		7.5	U	6.0	U	141	
G391	7.82		41	188	229	4.5	41	46	126	1.9		11		4.4		1.4	U	13	
G399	7.84		359	1,900	2,259	5.4	28	32	105	5.5		26		1.3	U	1.0	U	25	
G403	7.88		69	143	212	3.7	15	16	72	1.1		2	U	1.0	U	0.8	U	2.4	PASS
G407	7.97		51	288	339	3.6	34	38	124	2.4		23		5.6		1.3	U	97	
G410	8.01		29	118	147	4.1	37	41	116	1.2		14		1.9	U	1.5	U	22	
G413	8.03		13	104	117	2.4	17	28	142	0.52		6		1.1	U	0.9	U	51	PASS
G418	8.11	Upstream	31	150	181	4.2	40	46	137	1.8		200	>	6.2		1.6	U	14	
G422	8.15		229	419	648	3.8	34	40	205	5.2		38		1.4	U	1.1	U	84	
G423	8.21		22	148	170	4.4	35	46	186	1.1		17		1.8	U	1.5	U	49	
G427	8.30		74	240	314	4.1	34	48	160	3.9		21		1.7	U	1.3	U	80	
G431	8.32		490	3,600	4,090	2.9	26	75	167	14		5	U	16.0		2.1	U	127	
G432	8.33		565	2,550	3,115	3.8	36	81	343	19		13	U	6.5	U	24		590	
G434	8.35		1,420	7,200	8,620	4.1	28	47	189	11		47		6.5	U	5.5	U	245	
G437	8.40		113	553	666	3.7	27	44	157	4.4		37		1.4	U	1.2	U	56	PASS
G439	8.43		200	1,320	1,520	3.4	34	36	124	7.1		25		12.0		1.1	U	47	
G436	8.46		19	78	97	8.7	13	13	41	1.5		1.80	U	10.0		0.8	U	4.3	
Background Values:						7.0	42	36	86										
JSCS PEC Values:					22,800	33	111	149	459									676	
Mean Downstream (RM 7.5-7.8)			590	876	1,466	3.8	32	35	129	10.7		11		3.1		7.6		124	
Mean Adjacent (RM 7.8-8.1)			130	538	669	4.1	30	37	122	4.1		26		3.0		3.5		47	
Mean Upstream (RM 8.1-8.5)			316	1,626	1,942	4.3	31	48	171	6.9		40		6.3		4.0		130	
Harbor-wide Mean value			25,800	34,500	60,000	4.2	32	54	139	283		78		73		155		216	
Median Downstream (RM 7.5-7.8)			33	218	251	4.3	34	41	110	1.3		13		1.7		1.3		23	
Median Adjacent (RM 7.8-8.1)			51	188	229	4.2	34	40	124	1.9		16		1.9		1.4		25	
Median Upstream (RM 8.1-8.5)			157	486	657	4.0	34	46	164	4.8		23		6.4		1.4		68	
Harbor-wide Median Value			149	832	1,010	3.7	31	39	109	4.4		16		12		38		29	

Notes:

(1) Includes Level 1 results for *Chironomus* mortality (CM), *Chironomus* Growth (CG), and *Hyalella* Mortality (HM) endpoints

U = Undetected constituent; reporting limits have been halved for statistical calculations

ND = No data; detection limits have been elevated beyond usability due to matrix interference

Table 3b
Comparison of Portland Harbor Tissue Quality
Upstream, Downstream, and Adjacent to Site
Portland, Oregon

		Count	LPAHs ug/kg	HPAHs ug/kg	As mg/kg	Cr mg/kg	Cu mg/kg	Zn mg/kg	PCB 77 pg/g	PCB 81 pg/g	PCB 105 pg/g	PCB 114 pg/g	PCB 118 pg/g	PCB 123 pg/g	PCB 126 pg/g	PCB 167 pg/g	PCB 169 pg/g	PCB 189 pg/g
Field Clams																		
	Mean Up	3	100	237	0.94	0.58	9.1	41	552	20	2950	183	11310	206	16	745	5.3	23
	Site	1	23	113	0.95	0.65	9.4	31	141	2	987	62	3910	69	7	343	2.6	10
	Mean Downstream	7	188	1618	0.95	0.63	9.9	31	132	4	1032	60	3930	74	9	344	2.8	13
	Harborwide mean		72.4	564	0.94	0.668	9.9	36.2	225	9.23	1720	100	7530	137	14.6	903	15.6	47.5
	Harborwide 95th %		240	1060	1.06	0.92	11.6	46.9	609	20.5	4980	333	18900	326	27	1250	25.7	89.8
Lab Clams																		
	Mean Up	3	70	351	0.45	0.20	3.9	14	123	6	724	48	2818	60	5	232	0.9	2
	Site	1	7	38	0.37	0.21	3.1	12	32	1	304	17	1810	40	3	196	0.7	1
	Mean Downstream	5	9	28	0.39	0.21	3.6	14	204	6	1000	59	3770	75	7	256	0.7	4
	Harborwide mean		NA	NA	0.426	0.222	3.8	13.6	67.4	2.91	488	28.6	2340	47.9	4	218	1.6	3.06
	Harborwide 95th %		NA	NA	0.541	0.33	4.7	15.4	224	8.01	1140	64.6	4750	90.7	8.47	306	2.7	6.97
Lab Worm																		
	Mean Up	2	1771	11392	1.37	0.49	2.2	26	1302	67	5799	528	11390	337	32	255	3.9	56
	Site	1	87	588	1.94	0.63	2.1	28	325	9	1700	123	5010	95	14	238	2.0	59
	Mean Downstream	5	153	675	1.28	0.70	2.3	27	4563	179	15420	1143	41427	717	59	1119	7.3	163
	Harborwide mean		NA	NA	1.19	0.59	2.9	26.2	1020	43.8	5630	361	14600	282	33.7	700	23.2	191
	Harborwide 95th %		NA	NA	1.94	0.78	3.3	30.7	5780	311	24700	2360	44300	1470	118	2010	49.8	350
Crayfish																		
	Mean Up	2	143	246	0.33	0.61	14.4	17										
	Site	1	116	165	0.28	0.38	10.4	14										
	Mean Downstream	5	116	165	0.35	0.27	14.3	17										
Sculpin																		
	Mean Up	2	135	145	0.19	0.06	1.4	15										
	Site	1	98	140	0.19	0.04	1.5	16										
	Mean Downstream	4	159	151	0.17	0.20	1.4	17										
Notes:	NA = Not Available																	

Table 4
LWG Bioassay Testing Results
McCall Oil and Chemical

Table 4.1
Results of *Hyallella azteca* Mortality Test

Bioassay Station ID	Bioassay Type	Bioassay Variable	Mean survivorship	Mean Percent Mortality
Control	HYA28	Mortality	9.875	1.25
G401	HYA28	Mortality	9.625	3.75
G403	HYA28	Mortality	9.625	3.75
G413	HYA28	Mortality	9.875	1.25

Table 4.2
Results of *Chironomus tentans* Mortality Test

Bioassay Station ID	Bioassay Type	Bioassay Variable	Mean Survivorship	Mean Percent Mortality
Control	CHR10	Mortality	9.500	5.00
G401	CHR10	Mortality	9.375	6.25
G403	CHR10	Mortality	9.125	8.75
G413	CHR10	Mortality	9.375	6.25

Table 4.3
Results of *Chironomus tentans* Growth Test

Bioassay Station ID	Bioassay Type	Bioassay Variable	Mean Growth
Control	CHR10	Growth	1.08
G401	CHR10	Growth	1.01
G403	CHR10	Growth	1.07
G413	CHR10	Growth	1.15

Table 5
Risk Screening Evaluation of Site Stormwater
McCall Oil and Chemical

	JSCS (2007) Screening Levels and Other Criteria								Site Stormwater Concentrations																				
	Aquatic Life Criterion	Reference	Drinking Water Criterion	Reference	Fish Consump. (17.5 g/day)	Reference	Willamette R. Background (g)	NPDES 1200-Z Permit Limit (h)	Mean Site-Wide	S-1 12/20/00	S-1 03/06/02	S-1 04/07/05	S-1 11/12/07	S-2 12/20/00	S-2 03/06/02	S-2 04/07/05	S-2 05/02/07	S-2 11/12/07	S-3 12/15/00	S-3 03/06/02	S-3 04/07/05	S-3 05/02/07	S-3 11/12/07	S-4 12/15/00	S-4 Dupe 12/15/00	S-4 04/09/02	S-4 04/07/05	S-4 05/02/07	S-4 11/12/07
Metals (ug/L)																													
Arsenic - Total	150	e	10	a	0.140	b	2		0.51	0.5 U	0.5 U	0.5 U	0.7	1 U	0.5 U	0.5 U	0.5 U	0.8	1 U	0.5 U	0.5 U	0.5 U	0.7	--	--	0.6	0.5	1.5	1.1
Arsenic - Dissolved	150	e	10	a	0.140	b	2		0.35	--	--	0.5 U	0.5 U	--	--	--	0.5 U	0.6	--	--	0.5 U	0.5 U	0.5	0.5 U	0.5 U	--	0.5 U	0.5 U	0.8
Cadmium - Total	0.094	b	5	a	--		1		0.23	0.05 U	0.20 U	0.16	0.21	0.22	0.20 U	0.07	0.12	0.30	--	0.2 U	1.1	0.17	0.17	--	--	0.20	0.19	0.51	0.21
Cadmium - Dissolved	0.094	b	5	a	--		1		0.21	--	--	0.07	0.07	--	--	0.05	0.05	0.10	0.63	--	0.96	0.15	0.15	0.22	0.21	--	0.09	0.16	0.01
Chromium - Total	--		100	a	--		5.8		2.1	0.4	0.4	7.0	2.3	2.0	0.6	1.1	1.1	5.5	--	1.2	1.9	2.3	1.6	--	--	0.9	1.1	5.2	1.5
Chromium - Dissolved	--		100	a	--		5.8		0.90	--	--	1.3	0.5	--	--	0.7	0.7	0.8	2.9	--	1.3	0.9	0.9	0.8	0.6	--	0.2	0.50	0.50
Copper - Total	2.7	b	1,300	a	--		9	100	14	3.8	3.7	14	20	9.9	10	9.4	11.3	25.9	--	13.1	8.6	19	24	--	--	--	8.3	28	15
Copper - Dissolved	2.7	b	1,300	a	--		9		10	--	--	7.9	9.6	--	--	6.0	8.8	8.3	30	--	7.1	13	18	4.9	4.7	9.0	4.4	14	11
Lead - Total	0.54	b	15	a	--		13.3	400	8.5	0.43	0.31	27	10	5.9	1.1	2.3	3.2	24	--	2.3	4.1	4.9	4.0	--	--	3.3	6.2	36	9.9
Lead - Dissolved	0.54	b	15	a	--		13.3		0.65	--	--	0.61	0.32	--	--	0.7	0.86	1.1	1.6	--	1.1	0.75	0.90	0.05	0.04	--	0.09	0.54	0.39
Manganese - Total	120	d	--	a	100	b	150		54	--	--	--	25	--	--	--	8.4	72	--	--	--	24	23	--	--	--	--	169	55
Manganese - Dissolved	120	d	50	a	100	b	150		19	--	--	--	0.7	--	--	--	3.3	21	--	--	--	14	19	--	--	--	--	46	27
Mercury - Total	0.77	b	2	a	0.146	e	--		0.10	--	--	--	0.2 U	--	--	--	0.2 U	0.2 U	--	--	--	0.2 U	0.2 U	--	--	--	--	0.2 U	0.2 U
Mercury - Dissolved	0.77	b	2	a	0.146	e	--		0.10	--	--	--	0.2 U	--	--	--	0.2 U	0.2 U	--	--	--	0.2 U	0.2 U	--	--	--	--	0.2 U	0.2 U
Nickel - Total	16	b	730	c	4,600	b	5.5		3.3	--	--	--	2.3	--	--	--	1.2	3.8	--	--	--	2.7	2.7	--	--	--	--	6.9	3.8
Nickel - Dissolved	16	b	730	c	4,600	b	5.5		1.9	--	--	--	0.9	--	--	--	1.2	1.2	--	--	--	1.9	2.5	--	--	--	--	2.8	3.0
Silver - Total	0.12	e	100	a	--		0.3		0.04	--	--	--	0.02	--	--	--	0.02	0.02 U	--	--	--	0.07	0.02	--	--	--	--	0.12	0.02 U
Silver - Dissolved	0.12	e	100	a	--		0.3		0.01	--	--	--	0.02 U	--	--	--	0.02 U	0.02 U	--	--	--	0.03	0.02 U	--	--	--	--	0.02 U	0.02 U
Zinc - Total	36	b	5,000	a	26,000	b	38	600	170	200	195	87	154	113	73	51	149	353	--	84	189	375	334	--	--	87	90	252	103
Zinc - Dissolved	36	b	5,000	a	26,000	b	38		161	--	--	48	92	--	--	43	101	184	596	--	182	301	312	47.1	45	--	46.8	201	59
Low Molecular Weight PAHs (ug/L)																			**LPAHs**										
Naphthalene	194	f			--		--		0.02	0.03 J	0.03 J	0.03 J	0.03 J	0.07 J	0.03 J	0.01 U	0.02	0.02	0.07 J	0.03 J	0.01 U	0.01	0.02 U	0.04 J	0.04 J	0.01 U	0.01 U	0.02 Ui	0.02 U
Acenaphthylene	307	f			--		--		0.02	0.01 J	0.01 U	0.04 J	0.02 U	0.02 J	0.01 U	0.03 J	0.02 D	0.02 U	0.10 U	0.01 U	0.01 U	0.01 Ui	0.02 U	0.10 U	0.10 U	0.01 U	0.01 U	0.01 U	0.02 U
Acenaphthene	56	f			990	b	--		0.03	0.02 J	0.01 U	0.01 U	0.02 UJ	0.02 J	0.01 U	0.01 U	0.02 U	0.02 U	0.10 U	0.01 U	0.01 U	0.01 U	0.02 U	0.14	0.12	0.09 J	0.01 U	0.01 U	0.02 U
Fluorene	39	f			5,300	b	--		0.05	0.02 J	0.01 U	0.03 J	0.02 UJ	0.04 J	0.01 U	0.01 U	0.02 U	0.02 U	0.02 J	0.01 U	0.01 U	0.01	0.02 U	0.36	0.34	0.17 J	0.01 U	0.01 U	0.02 U
Phenanthrene	19	f			--		--		0.10	0.07 J	0.03 J	0.19 J	0.07 J	0.25	0.04 J	0.05 J	0.03	0.04	0.20	0.05 J	0.06 J	0.02	0.03	0.46	0.35	0.07 J	0.03 J	0.03 Ui	0.02 U
Anthracene	21	f			40,000	b	--		0.01	0.01 U	0.02 U	0.04 J	0.02 UJ	0.02 J	0.02 U	0.02 U	0.01 U	0.02 U	0.10 U	0.02 U	0.02 U	0.01 U	0.02 U	0.02 J	0.01 J	0.02 U	0.02 U	0.01 U	0.02 U
2-Methylnaphthalene	72	f			--		--		0.02	0.03 J	0.02 J	0.01 U	0.02 UJ	0.05 J	0.01 J	0.01 U	0.01 U	0.02 U	0.10	0.01 U	0.01 U	0.01 U	0.02 U	0.09 J	0.10	0.01 U	0.01 U	0.01	0.02 U
High Molecular Weight PAHs (ug/L)																			**HPAHs**										
Fluoranthene	7.1	f			140	b	--		0.05	0.02 J	0.01 U	0.23	0.09 J	0.10	0.02 J	0.06 J	0.02	0.03	0.06 J	0.02 J	0.04 J	0.02	0.02	0.06 J	0.05 J	0.01 U	0.01 U	0.05	0.02 U
Pyrene	10	f			4,000	b	--		0.07	0.02 J	0.02 U	0.28	0.08 J	0.12	0.03 J	0.06 J	0.02	0.03	0.03 J	0.02 J	0.04 J	0.02	0.02 U	0.19	0.16	0.10 J	0.10 J	0.08	0.03
Benz(a)anthracene	2.2	f	0.2	a	0.018	b	--		0.015	0.005 U	0.012 U	0.081 J	0.031 J	0.030 J	0.013 U	0.012 U	0.008 U	0.019 U	0.007 J	0.012 U	0.012 U	0.008 U	0.019 U	0.030 J	0.020 J	0.012 U	0.012 U	0.012	0.020 U
Chrysene	2.0	f	0.2	a	0.018	b	--		0.032	0.008 J	0.014 U	0.140 J	0.066 J	0.060 J	0.015 U	0.014 U	0.008 U	0.019 U	0.030 J	0.015 U	0.014 U	0.009	0.019 U	0.120	0.090 J	0.014 U	0.014 U	0.030	0.020 U
Benzo(b)fluoranthene	0.68	f	0.2	a	0.018	b	--		0.024	0.006 J	0.020 U	0.150 J	0.065 J	0.040 J	0.021 U	0.021 J	0.008 U	0.019 U	0.010 J	0.020 U	0.020 U	0.008 U	0.019 U	0.030 J	0.030 J	0.020 U	0.020 U	0.034	0.020 U
Benzo(k)fluoranthene	0.64	f	0.2	a	0.018	b	--		0.013	0.004 J	0.020 U	0.049 J	0.021 J	0.030 J	0.021 U	0.020 U	0.008 U	0.019 U	0.008 J	0.020 U	0.020 U	0.008 U	0.019 U	0.020 J	0.010 J	0.020 U	0.020 U	0.008 U	0.020 U
Benzo(a)pyrene	0.96	f	0.2	a	0.018	b	--		0.019	0.006 U	0.016 U	0.100 J	0.031 J	0.030 J	0.017 U	0.020 U	0.008 U	0.019 U	0.095 U	0.017 U	0.016 U	0.008 U	0.019 U	0.030 J	0.020 J	0.016 U	0.016 U	0.017	0.020 U
Indeno(1,2,3-cd)pyrene	0.28	f	0.2	a	0.018	b	--		0.018	0.006 J	0.024 U	0.089 J	0.035 J	0.040 J	0.026 U	0.020 U	0.008 U	0.019 U	0.010 J	0.025 U	0.024 U	0.008 U	0.019 U	0.020 J	0.020 J	0.024 U	0.024 U	0.020	0.020 U
Dibenz(a,h)anthracene	0.28	f	0.2	a	0.018	b	--		0.015	0.004 U	0.031 U	0.031 U	0.020 UJ	0.009 J	0.032 U	0.020 U	0.008 U	0.019 U	0.190 U	0.031 U	0.031 U	0.008 U	0.019 U	0.009 J	0.008 J	0.031 U	0.031 U	0.008 U	0.020 U
Benzo(g,h,i)perylene	0.44	f	--		--		--		0.023	0.007 J	0.017 U	0.140 J	0.041 J	0.060 J	0.018 U	0.020 U	0.009	0.019 U	0.010 J	0.017 U	0.017 U	0.008 U	0.019 U	0.040 J	0.030 J	0.017 U	0.017 U	0.027	0.020 U
Miscellaneous Semivolatiles																			**SVOCs**										
3- and 4-Methylphenol	--		180	c	--		--		0.19	0.30 J	0.23 J	0.05 U	0.50 U	0.49	0.09 J	0.05 U	0.48 U	0.50 U	0.48 U	0.22 J	0.12 J	0.48 U	0.49 U	0.20 J	0.20 J	0.05 U	0.05 U	0.48 U	0.47 U
Dibenzofuran	3.7	d	12	c	--		--		0.03	0.01 J	0.014 U	0.014 U	0.02 U	0.02 J	0.01 U	0.01 U	0.02 U	0.02 U	0.01 U	0.02 J	0.01 U	0.01	0.02 U	0.13	0.11	0.11 J	0.01 U	0.013 Ui	0.02 U
Dimethyl Phthalate	3.0	e	370,000	c	1.1E+06		--		0.37	--	--	--	0.36	--	--	--	0.22	0.66	--	--	--	0.32	0.46	--	--	--	--	0.29	0.25
Diethyl Phthalate	210	e	29,000	c	44,000	b	--		0.21	--	--	--	0.20 U	--	--	--	0.47	0.24	--	--	--	0.20 U	0.22	--	--	--	--	0.20 U	0.26
Di-n-butyl Phthalate	35	e	3,700	c	4,500	b	--		0.15	--	--	--	0.20 U	--	--	--	0.21	0.35	--	--	--	0.20 U	0.20 U	--	--	--	--	0.20 U	0.19 U
Butyl Benzyl Phthalate	19	e	7,300	c	1,900	b	--		0.10	0.10 J	0.19 J	0.20	0.20 U	0.10 J	0.05 J	0.08 J	0.20 U	0.20 U	0.08 J	0.09 J	0.09 J	0.20 U	0.20 U	0.05 J	0.04 J	0.14 J	0.10 J	0.20 U	0.19 U
Bis(2-ethylhexyl) Phth.	3.0	e	4.8	c	2.2	b	--		1.78	--	--	--	0.99 U	--	--	--	1.4	6.7	--	--	--	0.96 U	2.4	--	--	--	--	0.96 U	0.94 U
Di-n-octyl Phthalate	3.0	e	1,500	c	--		--		0.12	0.003 U	0.03 U	0.03 U	0.20 U	0.003 U	0.03 U	0.11 J	0.20 U	0.20 U	0.95 U	0.03 U	0.03 U	0.20 U	0.20 U	0.95 U	0.96 U	0.032 U	0.032 U	0.20 U	0.19 U

Table 5
Risk Screening Evaluation of Site Stormwater
McCall Oil and Chemical

	JSCS (2007) Screening Levels and Other Criteria								Site Stormwater Concentrations																				
	Aquatic Life Criterion	Reference	Drinking Water Criterion	Reference	Fish Consump. (17.5 g/day)	Reference	Willamette R. Background (g)	NPDES 1200-Z Permit Limit (h)	Mean Site-Wide	S-1 12/20/00	S-1 03/06/02	S-1 04/07/05	S-1 11/12/07	S-2 12/20/00	S-2 03/06/02	S-2 04/07/05	S-2 05/02/07	S-2 11/12/07	S-3 12/15/00	S-3 03/06/02	S-3 04/07/05	S-3 05/02/07	S-3 11/12/07	S-4 12/15/00	S-4 Dupe 12/15/00	S-4 04/09/02	S-4 04/07/05	S-4 05/02/07	S-4 11/12/07
Polychlorinated Biphenyls									PCBs																				
Arochor 1016	--		0.96	c	--		--		0.10	--	--	--	0.20 U	--	--	--	0.20 U	0.20 U	--	--	--	0.20 U	0.20 U	--	--	--	--	0.20 U	0.20 U
Arochor 1221	0.28	d	0.034	c	--		--		0.20	--	--	--	0.39 U	--	--	--	0.39 U	0.40 U	--	--	--	0.39 U	0.39 U	--	--	--	--	0.39 U	0.39 U
Arochor 1232	0.58	d	0.034	c	--		--		0.10	--	--	--	0.20 U	--	--	--	0.20 U	0.20 U	--	--	--	0.20 U	0.20 U	--	--	--	--	0.20 U	0.20 U
Arochor 1242	0.053	d	0.034	c	--		--		0.10	--	--	--	0.20 U	--	--	--	0.20 U	0.20 U	--	--	--	0.20 U	0.20 U	--	--	--	--	0.20 U	0.20 U
Arochor 1248	0.081	d	0.034	c	--		--		0.10	--	--	--	0.20 U	--	--	--	0.20 U	0.20 U	--	--	--	0.20 U	0.20 U	--	--	--	--	0.20 U	0.20 U
Arochor 1254	0.033	d	0.034	c	--		--		0.10	--	--	--	0.20 U	--	--	--	0.20 U	0.20 U	--	--	--	0.20 U	0.20 U	--	--	--	--	0.20 U	0.20 U
Arochor 1260	94	d	0.034	c	--		--		0.10	--	--	--	0.20 U	--	--	--	0.20 U	0.20 U	--	--	--	0.20 U	0.20 U	--	--	--	--	0.20 U	0.20 U
Total Petroleum Hydrocarbons (mg/L)																													
Gasoline Range									0.23	**1.1** Z	0.11 U	0.1 U	0.25 U	0.1 U	**0.13** Z	0.1 U	0.25 U	0.25 U	**1.3** Z	0.11 U	**0.12** Z	0.25 U	0.25 U	**0.27** Z	**0.26** Z	**0.22** H	0.1 U	0.25 U	0.25 U
Diesel Range									0.38	0.1 U	0.11 U	**0.34** H	**0.33** H	0.1 U	0.11 U	**0.31** Y	0.25 U	**0.5** H	**0.51** Z	**0.11** Z	**0.55** Y	**0.29** Z	**0.29** Y	**0.28** Z	**0.3** Z	**1.3** F	**0.44** Y	**1** Z	**0.74** Y
Residual Oil Range									0.42	0.25 U	0.27 U	**0.88** O	**0.61** O	0.25 U	0.26 U	**0.43** O	0.5 U	**1.6** O	0.25 U	0.26 U	**1** O	0.5 U	0.5 U	0.25 U	0.25 U	**0.55** O	**0.34** L	**0.94** Z	0.5 U
Total Petroleum								10	1.00	**1.1**	0	**1.22**	**0.94**	0	**0.13**	**0.74**	0	**2.1**	**1.81**	**0.11**	**1.67**	**0.29**	**0.29**	**0.55**	**0.56**	**2.07**	**0.78**	**1.94**	**0.74**

Legend:

- Concentration above ecological screening level and Willamette River background
- Mean concentration above human health screening level and Willamette River background

Notes:

U = Not detected at indicated quantitation limit; J = Estimated concentration; Bold value = detected concentration

(a) MCL
(b) EPA 2004 NRWQC
(c) Tap water PRGs
(d) Oak Ridge National Laboratory's (Tier II SCV)
(e) DEQ's 2004 AWQC (chronic)
(f) EPA (2003) Final Chronic Values
(g) Fuhrer et al., 1996; DEQ, 2002; 90th percentile value for Lower Columbia Basin
(h) NPDES Oil and Grease Limit used to evaluate TPH

Table 6
Risk Screening Evaluation of Shoreline Groundwater
McCall Oil and Chemical

	JSCS (2007) Screening Levels and Other Criteria								Shoreline Groundwater Monitoring Wells																	
	Aquatic Life Criterion	Reference	Drinking Water Criterion	Reference	Fish Consump. (17.5 g/day)	Reference	Willamette R. Background (g)	NPDES 1200-Z Permit Limits	Mean Site-Wide	EX-2 12/20/00	EX-2 03/07/02	EX-2 10/04/02	EX-2 02/12/04	EX-2 10/21/04	EX-3 12/20/00	EX-3 03/07/02	EX-3 10/04/02	EX-3 02/12/04	EX-3 10/21/04	EX-5 12/20/00	EX-5 03/07/02	EX-5 10/04/02	MW-5 12/20/00	MW-5 03/07/02	MW-5 10/03/02	MW-5 Dup 10/03/02
Metals (ug/L)																										
Arsenic - Total	150	e	10	a	0.140	b	2		26.2	--	--	--	**57**	**65**	--	--	--	**87**	**90**	--	--	--	--	--	--	--
Arsenic - Dissolved	150	e	10	a	0.140	b	2		22.1	--	--	--	**66**	**72**	--	--	--	**86**	**90**	--	--	--	--	--	--	--
Chromium - Total	74	b	100	a	--		5.8		35.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium - Dissolved	74	b	100	a	--		5.8		1.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper - Total	2.7	b	1,300	a	--		9	100	57	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper - Dissolved	2.7	b	1,300	a	--		9		0.8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Low Molecular Weight PAHs (µg/L)																										
Naphthalene	194	f			--		--		0.03	**0.01** J	0.01 U	**0.02** J	**0.02** J	0.01 U	**0.02** J	0.01 U	**0.04** J	0.01 U	0.01 U	**0.01** J	**0.03** J	**0.02** J	0.01 U	**0.03** J	0.01 U	**0.02**
Acenaphthylene	307	f			--		--		0.01	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Acenaphthene	56	f			990	b	--		0.08	**0.02** J	**0.04** J	**0.11** J	**0.03** J	**0.04** J	**0.01** J	0.01 U	**0.02** J	0.01 U	0.01 U	**0.01** J	**0.02** J	**0.02** J	0.01 U	0.01 U	0.01 U	0.01 U
Fluorene	39	f			5,300	b	--		0.07	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Phenanthrene	19	f			--		--		0.14	**0.04** J	**0.05** J	**0.06** J	**0.04** J	**0.02** J	**0.04** J	**0.06** J	**0.06** J	**0.03** J	**0.02** J	**0.02** J	**0.03** J	**0.04** J	0.01 U	0.01 U	**0.02** J	**0.02** J
Anthracene	21	f			40,000	b	--		0.03	0.01 U	0.02 U	0.02 U	0.02 U	0.02 U	0.01 U	**0.02** J	**0.02** J	0.02 U	0.02 U	0.01 U	0.02 U	**0.02** J	0.01 U	0.02 U	**0.03** J	**0.02** J
2-Methylnaphthalene	72	f			--		--		0.02	**0.01** J	**0.01** J	**0.02** J	**0.01** J	0.01 U	0.01 U	0.01 U	**0.02** J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
High Molecular Weight PAHs (µg/L)																										
Fluoranthene	7.1	f			140	b	--		0.046	**0.01** J	**0.02** J	0.01 U	0.01 U	0.01 U	**0.01** J	**0.04** J	**0.03** J	0.01 U	0.01 U	**0.01** J	0.01 U	0.01 U	0.01 U	0.01 U	**0.03** J	**0.03** J
Pyrene	10	f			4,000	b	--		0.081	**0.03** J	**0.04** J	**0.07** J	**0.04** J	**0.03** J	**0.03** J	**0.06** J	**0.06** J	**0.03** J	**0.03** J	**0.04** J	**0.05** J	**0.07** J	0.01 U	**0.02** J	**0.04** J	**0.03** J
Benz(a)anthracene	2.2	f	0.2	a	0.018	b	--		0.023	**0.007** J	0.013 U	0.012 U	0.012 U	0.012 U	**0.008** J	0.013 U	0.012 U	0.012 U	0.012 U	**0.006** J	0.013 U	0.012 U	0.005 U	0.013 U	**0.030** J	0.012 U
Chrysene	2.0	f	0.2	a	0.018	b	--		0.032	**0.007** J	0.015 U	0.014 U	0.014 U	0.014 U	**0.010** J	0.015 U	0.014 U	0.014 U	0.014 U	**0.008** J	0.015 U	0.014 U	0.006 U	0.015 U	**0.022** J	0.014 U
Benzo(b)fluoranthene	0.68	f	0.2	a	0.018	b	--		0.022	**0.006** J	0.021 U	0.020 U	0.020 U	0.020 U	**0.006** J	0.021 U	0.020 U	0.020 U	0.020 U	0.005 U	0.021 U	0.020 U	0.005 U	0.021 U	0.020 U	0.020 U
Benzo(k)fluoranthene	0.64	f	0.2	a	0.018	b	--		0.013	**0.006** J	0.021 U	0.020 U	0.020 U	0.020 U	**0.006** J	0.021 U	0.020 U	0.020 U	0.020 U	**0.003** J	0.021 U	0.020 U	0.003 U	0.021 U	0.020 U	0.020 U
Benzo(a)pyrene	0.96	f	0.2	a	0.018	b	--		0.022	**0.007** J	0.017 U	0.016 U	0.016 U	0.016 U	**0.007** J	0.017 U	0.016 U	0.016 U	0.016 U	0.006 U	0.017 U	0.016 U	0.006 U	0.018 U	0.016 U	0.016 U
Indeno(1,2,3-cd)pyrene	0.28	f	0.2	a	0.018	b	--		0.020	**0.009** J	0.026 U	0.024 U	0.024 U	0.024 U	**0.009** J	0.026 U	0.024 U	0.024 U	0.024 U	**0.007** J	0.026 U	0.024 U	0.004 U	0.026 U	0.024 U	0.024 U
Dibenz(a,h)anthracene	0.28	f	0.2	a	0.018	b	--		0.014	**0.005** J	0.033 U	0.031 U	0.031 U	0.031 U	0.004 U	0.033 U	0.031 U	0.031 U	0.031 U	0.004 U	0.033 U	0.031 U	0.004 U	0.033 U	0.031 U	0.031 U
Benzo(g,h,i)perylene	0.44	f	--		--		--		0.028	**0.010** J	0.018 U	0.017 U	0.017 U	0.017 U	**0.020** J	**0.034** J	**0.025** J	0.017 U	0.017 U	**0.030** J	**0.054** J	**0.031** J	0.005 U	0.018 U	0.017 U	0.017 U
Miscellaneous Semivolatiles (µg/L)																										
3- and 4-Methylphenol	--		180	c	--		--		0.12	**0.02** J	0.06 U	0.05 U	0.05 U	0.05 U	**0.05** J	**0.09** J	**0.09** J	0.05 U	0.05 U	**0.01** J	0.06 U	0.05 U	0.00 U	0.06 U	0.05 U	0.05 U
Dibenzofuran	3.7	d	12	c	--		--		0.02	0.007 U	0.014 U	0.014 U	0.014 U	0.014 U	0.007 U	0.014 U	0.014 U	0.014 U	0.014 U	0.007 U	0.014 U	0.014 U	0.007 U	0.015 U	0.200 U	0.014 U
Butyl Benzyl Phthalate	19	d	7,300	c	1,900	b	--		0.02	0.02 U	0.03 U	0.03 U	0.03 U	0.03 U	0.02 U	0.03 U	0.03 U	0.03 U	0.03 U	0.02 U	0.03 U	0.03 U	0.02 U	0.03 U	**0.05** J	0.03 U
Di-n-octyl Phthalate	3.0	e	1,500	c	--		--		0.01	0.00 U	0.04 U	0.03 U	0.03 U	0.03 U	0.00 U	0.04 U	0.03 U	0.03 U	0.03 U	0.00 U	0.04 U	0.03 U	0.00 U	0.04 U	0.01 U	0.01 U
Total Petroleoum Hydrocarbons (µg/L)																										
Gasoline Range	--		--		--		--																			
Diesel Range	--		--		--		--																			
Residual Oil Range	--		--		--		--																			
Total Petroleum	--		--		--		--	10 (h)																		
Volatile Organic Compounds (µg/L)																										
Carbon Disulfide	0.92	d	1,000	c	--		--		NC	0.5 U	0.5 U	0.5 U	--	--	0.5 U	0.5 U	0.5 U			0.5 U	0.5 U	**1.4**	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethylene	590	d	61	c	--		--		NC	0.5 U	0.5 U	0.5 U	--	--	0.5 U	0.5 U	0.5 U	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	9.8	d	1,000	a	15,000	b	--		NC	0.5 U	0.5 U	0.5 U	--	--	0.5 U	0.5 U	**1.3**			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	--		0.015	c	2.4	b	--		NC	0.5 U	0.5 U	0.5 U	--	--	0.5 U	0.5 U	0.5 U	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Legend:
- (yellow) Concentration above ecological SLV and Willamette River background
- (shaded) Mean concentration above human health SLV and Willamette River background
- NC Not calculated due to insufficient detections

Notes:
U = Not detected at indicated quantitation limit; J = Estimated concentration; Bold value = detected concentration
(a) MCL
(b) EPA 2004 NRWQC
(c) Tap water PRGs
(d) Oak Ridge National Laboratory's (Tier II SCV)
(e) DEQ's 2004 AWQC (chronic)
(f) EPA (2003) Final Chronic Values
(g) Fuhrer et al., 1996; DEQ, 2002; 90th percentile value for Lower Columbia Basin
(h) NPDES Oil and Grease Limit used to evaluate TPH

Table 6
Risk Screening Evaluation of Shoreline Groundwater
McCall Oil and Chemical

	JSCS (2007) Screening Levels and Other Criteria								Shoreline Groundwater Monitoring Wells														
	Aquatic Life Criterion	Reference	Drinking Water Criterion	Reference	Fish Consump. (17.5 g/day)	Reference	Willamette R. Background (g)	NPDES 1200-Z Permit Limits	MW-5 02/11/04	MW-5 10/22/04	MW-7 10/25/01	MW-7 03/08/02	MW-7 10/04/02	MW-7 02/12/04	MW-7 Dup 02/12/04	MW-7 10/21/04	MW-8 10/25/01	MW-8 03/07/02	MW-8 10/04/02	MW-8 02/12/04	MW-8 10/21/04	MW-14 02/11/04	MW-14 10/21/04
Metals (ug/L)																							
Arsenic - Total	150	e	10	a	0.140	b	2		**16**	**25**	**18**	**4.4**	--	**5.0**	**5.0**	**5.1**	**44**	**4.3**	--	**5.4**	**10.1**	**1.5**	**2.7**
Arsenic - Dissolved	150	e	10	a	0.140	b	2		**15**	**20**	**3.0**	**3.5**	**9.1**	**5.1**	**5.1**	**6.3**	**2.3**	**8.6**	**9.6**	**5.6**	**10.3**	**1.5**	**1.5**
Chromium - Total	74	b	100	a	--		5.8		--	--	**127**	**9.1**	--	**0.7**	**0.8**	**1.1**	**225**	**15**	--	**1.7**	**3.1**	**1.3**	**0.6**
Chromium - Dissolved	74	b	100	a	--		5.8		--	--	1.0 U	**2.3**	**2.1**	**2.0**	**0.7**	**1.1**	1.0 U	**2.9**	**1.4**	**0.8**	**1.0**	**2.6**	**0.5**
Copper - Total	2.7	b	1,300	a	--		9	100	--	--	**164**	**19**	--	**0.5**	**0.4**	0.1 U	**394**	**36**	--	**2.0**	**3.8**	**1.7**	**2.4**
Copper - Dissolved	2.7	b	1,300	a	--		9		--	--	2.0 U	**1.3**	**0.7**	**0.7**	**0.3**	0.1 U	2.0 U	**1.3**	**0.3**	**0.2**	0.1 U	**1.3**	**2.1**
Low Molecular Weight PAHs (µg/L)																							
Naphthalene	194	f			--		--		**0.03** J	0.01 U	5.00 U	**0.09** J	**0.02** J	0.01 U	0.01 U	0.01 U	5.00 U	**0.16** J	**0.38**	**0.03** J	0.01 U	**0.02** J	0.01 U
Acenaphthylene	307	f			--		--		0.01 U	0.01 U	5.00 U	**0.03** J	0.01 U	0.01 U	0.01 U	0.01 U	5.00 U	0.01 U	**0.21**	0.01 U	0.01 U	0.01 U	0.01 U
Acenaphthene	56	f			990	b	--		0.01 U	0.01 U	5.00 U	0.01 U	0.01 U	0.01 U	**0.05** J	**0.03** J	5.00 U	**0.58**	**0.78**	**0.34**	**0.21**	**0.03** J	0.01 U
Fluorene	39	f			5,300	b	--		0.01 U	0.01 U	5.00 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	5.00 U	**0.56**	**0.91**	**0.36**	**0.22**	0.01 U	0.01 U
Phenanthrene	19	f			--		--		0.01 U	0.01 U	5.00 U	**0.08** J	**0.03** J	**0.02** J	**0.04** J	0.01 U	5.00 U	**1.20**	**1.70**	**0.22**	**0.22**	0.01 U	0.01 U
Anthracene	21	f			40,000	b	--		0.02 U	0.02 U	5.00 U	**0.04** J	**0.03** J	**0.02** J	**0.03** J	0.02 U	5.00 U	**0.10** J	**0.38**	**0.03** J	0.02 U	0.02 U	0.02 U
2-Methylnaphthalene	72	f			--		--		0.01 U	0.01 U	5.00 U	**0.03** J	0.01 U	0.01 U	0.01 U	0.01 U	5.00 U	**0.08** J	**0.16** J	0.01 U	**0.00** J	0.01 U	0.01 U
High Molecular Weight PAHs (µg/L)																							
Fluoranthene	7.1	f			140	b	--		0.01 U	0.01 U	5.0 U	**0.06** J	0.01 U	0.01 U	0.01 U	0.01 U	5.0 U	**0.22**	**0.73**	**0.04** J	**0.05** J	0.01 U	0.01 U
Pyrene	10	f			4,000	b	--		0.02 U	0.02 U	5.0 U	**0.09** J	**0.03** J	0.02 U	0.02 U	0.02 U	5.0 U	**0.34**	**1.10**	**0.07** J	**0.08** J	0.02 U	0.02 U
Benz(a)anthracene	2.2	f	0.2	a	0.018	b	--		0.012 U	0.012 U	5.0 U	**0.044** J	0.012 U	0.012 U	0.012 U	0.012 U	5.0 U	**0.071** J	**0.390**	0.012 U	0.012 U	0.012 U	0.012 U
Chrysene	2.0	f	0.2	a	0.018	b	--		0.014 U	0.014 U	5.0 U	**0.045** J	0.014 U	0.014 U	0.014 U	0.014 U	5.0 U	**0.160** J	**0.560**	0.014 U	0.014 U	0.014 U	0.014 U
Benzo(b)fluoranthene	0.68	f	0.2	a	0.018	b	--		0.020 U	0.020 U	5.0 U	0.021 U	0.020 U	0.020 U	0.020 U	0.020 U	5.0 U	**0.064** J	**0.350**	0.020 U	0.020 U	0.020 U	0.020 U
Benzo(k)fluoranthene	0.64	f	0.2	a	0.018	b	--		0.020 U	0.020 U	5.0 U	0.021 U	0.020 U	0.020 U	0.020 U	0.020 U	5.0 U	0.020 U	**0.130** J	0.020 U	0.020 U	0.020 U	0.020 U
Benzo(a)pyrene	0.96	f	0.2	a	0.018	b	--		0.016 U	0.016 U	5.0 U	0.017 U	0.016 U	0.016 U	0.016 U	0.016 U	5.0 U	**0.089** J	**0.360**	0.016 U	0.016 U	0.016 U	0.016 U
Indeno(1,2,3-cd)pyrene	0.28	f	0.2	a	0.018	b	--		0.024 U	0.024 U	5.0 U	0.026 U	0.024 U	0.024 U	0.024 U	0.024 U	5.0 U	**0.040** J	**0.250**	0.024 U	0.024 U	0.024 U	0.024 U
Dibenz(a,h)anthracene	0.28	f	0.2	a	0.018	b	--		0.031 U	0.031 U	5.0 U	0.032 U	0.031 U	0.031 U	0.031 U	0.031 U	5.0 U	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U	0.031 U
Benzo(g,h,i)perylene	0.44	f	--		--		--		0.017 U	0.017 U	5.0 U	**0.099** J	0.017 U	0.017 U	0.017 U	0.017 U	5.0 U	**0.057** J	**0.310**	0.017 U	0.017 U	0.017 U	0.017 U
Miscellaneous Semivolatiles (µg/L)																							
3- and 4-Methylphenol	--		180	c	--		--		0.05 U	0.05 U	5.00 U	**1.1**	0.05 U	0.05 U	0.05 U	0.05 U	5.00 U	**0.22** J	**1.6**	0.05 U	0.05 U	0.05 U	0.05 U
Dibenzofuran	3.7	d	12	c	--		--		0.014 U	0.014 U	5.00 U	0.014 U	0.014 U	0.014 U	0.014 U	0.014 U	5.00 U	**0.18** J	0.014 U	**0.092** J	0.014 U	0.014 U	0.014 U
Butyl Benzyl Phthalate	19	d	7,300	c	1,900	b	--		0.03 U	0.03 U	5.00 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	5.00 U	**0.13** J	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
Di-n-octyl Phthalate	3.0	e	1,500	c	--		--		0.03 U	0.03 U	5.00 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	5.00 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
Total Petroloeum Hydrocarbons (µg/L)																							
Gasoline Range	--		--		--		--																
Diesel Range	--		--		--		--																
Residual Oil Range	--		--		--		--																
Total Petroleum	--		--		--		--	10 (h)															
Volatile Organic Compounds (µg/L)																							
Carbon Disulfide	0.92	d	1,000	c	--		--		0.5 U	0.5 U	10.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	10.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethylene	590	d	61	c	--		--		0.5 U	0.5 U	**2.9**	**2.1**	**2.5**	**5.2**	**5.3**	**3.2**	**1.2**	0.5 U	**1.1**	0.5 U	**1.2**	0.5 U	**1.0**
Toluene	9.8	d	1,000	a	15,000	b	--		0.5 U	0.5 U	1.0 U	**3.4**	**2.4**	0.5 U	0.5 U	0.5 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl Chloride	--		0.015	c	2.4	b	--		0.5 U	0.5 U	1.0 U	0.5 U	0.5 U	**1.4**	**1.4**	**0.8**	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Legend:

- (yellow) Concentration above ecological SLV and Willamette River background
- (shaded) Mean concentration above human health SLV and Willamette River background
- NC Not calculated due to insufficient detections

Notes:

U = Not detected at indicated quantitation limit; J = Estimated concentration; Bold value = detected concentration

(a) MCL
(b) EPA 2004 NRWQC
(c) Tap water PRGs
(d) Oak Ridge National Laboratory's (Tier II SCV)
(e) DEQ's 2004 AWQC (chronic)
(f) EPA (2003) Final Chronic Values
(g) Fuhrer et al., 1996; DEQ, 2002; 90th percentile value for Lower Columbia Basin
(h) NPDES Oil and Grease Limit used to evaluate TPH

Table 7
Risk Screening Evaluation of Bank Soil and Catch Basin Sediment
McCall Oil and Chemical

	MacDonald PECs and other SQVs	ODEQ 2007 Bioaccumulation SLVs	Bank Surface Soils						Stormwater Catch Basin Sediment								Outfall
			GP-14 0-2 Soil 12/13/00	GP-15 0-2 Soil 12/13/00	GP-16 0-2 Soil 12/13/00	GP-17 0-2 Soil 12/13/00	GP-18 0-2 Soil 12/14/00	GP-19 0-2 Soil 12/14/00	Mean Siite-Wide	S-1 Sediment 12/15/00	S-1 Sediment 11/12/07	S-2 Sediment 12/15/00	S-2 Sediment 11/12/07	S-3 Sediment 12/15/00	S-3 Sediment 11/04/04	S-3 Sediment 05/02/07	S3-01C Sediment 12/15/00
Metals (mg/kg)																	
Arsenic	33	7	2.2	1.7	1.6	1.5	1.3	1.6	14	5.2	4.4	7.5	4.6	38	26	10	4.4
Cadmium	4.98	1							1.8	2.0	1.8	1.4	1.1	2.9	1.9	1.6	0.12
Chromium	111	--	13	11	11	10	9	10	106	49	122	64	95	144	189	79	12
Copper	149	--	17	18	15	13	14	12	502	137	214	316	115	1,050	1,360	321	27
Lead	128	17							312	145	312	211	256	454	600	206	8.6
Manganese	1,100	--							606		845		511			462	
Mercury	1.06	0.07							0.17		0.08		0.20			0.24	
Nickel	48.6	--							45		52		39			44	
Silver	5	--							0.60		0.55		0.33			0.92	
Zinc	459	--							868	638	1,550	584	630	985	752	938	83
Low Molecular Weight PAHs (ug/kg)																	
Naphthalene	561	--	7.5 U	1 J	1 J	7.4 U	7.6 U	7.3 U	201	200 JD	270	50 JD	290	400 JD	64 JD	130	12 U
Acenaphthylene	200	--	0.7 J	0.5 J	7.6 U	7.4 U	7.6 U	7.3 U	34	40 JD	42	20 JD	28	60 JD	37 JU	31	12 U
Acenaphthene	300	--	7.5 U	7.6 U	7.6 U	7.4 U	7.6 U	7.3 U	125	200 JD	230	30 JD	21	720 U	26 JU	24	12 U
Fluorene	536	--	7.5 U	0.8 J	7.6 U	7.4 U	7.6 U	7.3 U	571	100 JD	130	20 JD	26	3,600 D	72 JD	47	12 U
Phenanthrene	1,170	--	7.5 U	13	3 J	7.4 U	7.6 U	7.3 U	1,146	1,500 D	950	320 D	320	3,600 D	660 JD	670	12 U
Anthracene	845	--	0.9 J	2 J	7.6 U	7.4 U	7.6 U	7.3 U	505	400 JD	230	50 JD	56	2,600 D	140 JD	58	12 U
2-Methylnaphthalene	200	--	0.6 J	1 J	1 J	7.4 U	0.5 J	7.3 U	123	100 JD	180	50 JD	33	400 JD	31 JU	80	1 J
High Molecular Weight PAHs (ug/kg)																	
Fluoranthene	2,230	37,000	6 J	34	8 J	5 J	6 J	2 J	1,904	2,600 D	1,400	690 D	660	5,800 D	1,400 JD	780	3 J
Pyrene	1,520	1,900	7 J	29	7 J	4 J	6 J	2 J	1,859	2,600 D	1,300	770 D	640	5,500 D	1,200 JD	1,000	3 J
Benz(a)anthracene	1,050	--	4 J	17	5 J	3 J	3 J	2 J	794	1,300 D	470	440 D	220	2,500 D	400 JD	230	2 J
Chrysene	1,290	--	7 J	28	7 J	5 J	6 J	2 J	1,561	2,000 D	880	740 D	520	5,300 D	1,100 JD	390	3 J
Benzo(b)fluoranthene	--	--	5 J	25	6 J	4 J	5 J	2 J	1,461	2,000 D	930	780 D	750 X	4,100 D	1,100 JD	570	3 J
Benzo(k)fluoranthene	13,000	--	5 J	22	6 J	3 J	4 J	2 J	885	1,500 D	300	540 D	6 U	3,400 D	270 JD	180	2 J
Benzo(a)pyrene	1,450	--	6 J	24	5 J	4 J	4 J	2 J	1,136	1,900 D	540	670 D	330	3,700 D	490 JD	320	2 J
Indeno(1,2,3-cd)pyrene	100	--	6 J	24	7 J	5 J	5 J	2 J	1,027	1,500 D	570	490 D	400	3,200 D	530 JD	500	2 J
Dibenz(a,h)anthracene	1,300	--	1 J	5 J	1 J	1 J	1 J	1 J	231	300 JD	88	100 JD	78	800 JD	150 JD	100	24 U
Benzo(g,h,i)perylene	300	--	8 J	23	8 J	6 J	5 J	2 J	1,299	1,600 D	810	500 D	690	3,600 D	790 JD	1,100	3 J
Miscellaneous Semivolatiles (ug/kg)																	
3- and 4-Methylphenol	--	--	150 U	150 U	150 U	150 U	150 U	150 U	NC	13,000 U	650 UJ	1,900 U	7,100 J	4,000 JD	3,000 JD	680 U	240 U
Dibenzofuran	--	--	0.6 J	0.8 J	7.6 U	7.4 U	7.6 U	7.3 U	82	100 JD	100 JD	20 JD	20 JD	200 JD	69 JD	67	12 U
Dimethyl Phthalate	--	--	15 U	4 J	0.7 J	1 J	1 J	1 J	ND		650 UJ		640 UJ			680 U	
Diethyl Phthalate	600	--							ND		650 UJ		640 UJ			680 U	
Di-n-butyl Phthalate	--	60?							713		1,300 UJ		1,300 UJ			840 D	
Butyl Benzyl Phthalate	--	--							2,724	1,500 D	1,200 J	2,500 D	7,600 J	5,000 D	930 JD	680 U	1 J
Bis(2-ethylhexyl) Phth	--	330?							9,900		8,700 J		9,000 J			12,000 D	
Di-n-octyl Phthalate	--	--	150 U	150 U	150 U	150 U	150 U	0.8 J	ND	13,000 U	13,000 UJ	1,900 U	1,300 UJ	14,000 U	11,000 JD	680 U	2 J

Table 7
Risk Screening Evaluation of Bank Soil and Catch Basin Sediment
McCall Oil and Chemical

	MacDonald PECs and other SQVs	ODEQ 2007 Bioaccumulation SLVs	Bank Surface Soils						Stormwater Catch Basin Sediment								Outfall
			GP-14 0-2 Soil 12/13/00	GP-15 0-2 Soil 12/13/00	GP-16 0-2 Soil 12/13/00	GP-17 0-2 Soil 12/13/00	GP-18 0-2 Soil 12/14/00	GP-19 0-2 Soil 12/14/00	Mean Siite-Wide	S-1 Sediment 12/15/00	S-1 Sediment 11/12/07	S-2 Sediment 12/15/00	S-2 Sediment 11/12/07	S-3 Sediment 12/15/00	S-3 Sediment 11/04/04	S-3 Sediment 05/02/07	S3-01C Sediment 12/15/00
Polychlorinated Biphenyls (ug/kg)																	
Arochor 1016	530	--							ND		13 U		13 U			11 U	
Arochor 1221	--	--							ND		26 U		26 U			22 U	
Arochor 1232	--	--							ND		13 U		13 U			11 U	
Arochor 1242	--	--							ND		**23** P		13 U			11 U	
Arochor 1248	1500	--							ND		13 U		13 U			11 U	
Arochor 1254	300	--							47		**57**		28 Ui			**69**	
Arochor 1260	200	--							50		**46**		**30**			**75**	
Total PCBs	676	0.39							100		**126**		**30**			**144**	
Total Petroleum Hydrocarbons (mg/kg)																	
Gasoline	--	--	10 U	10 U	10 U	10 U	10 U	10 U	107	**26** Y	13 U	**21** Y	13 U	**580** Y	210 U	14 U	10 U
Diesel	--	--	**14** F	10 U	10 U	**13** H	**21** H	10 U	1,141	**400** H	**590** DH	**300** H	**1,300** DH	**2,400** H	**1,600** JH	**1,400** DH	10 U
Residual Oil	--	--	**55** F	**30** Z	**49** F	**84** F	**210** F	25 U	6,443	**1,900** O	**4,600** DO	**2,200** DO	**11,000** DO	**7,600** DO	**8,500** JO	**9,300** DO	**30** Y
Total Petroleum	--	--	**69**	**30**	**49**	**97**	**231**	0	7,674	**2,326**	**5,190**	**2,521**	**12,300**	**10,580**	**10,100**	**10,700**	**30**

Legend:

(yellow)	Concentration above ecological screening level
(shaded)	Mean concentration above human health screening level
ND	Not detected
NC	Not calculated due to insufficient detections

Notes:

U = not detected at or above the indicated method reporting limit.

J = estimated concentration. D = reported result is from a dilution.

Table 8
Trend Analysis of Ten-Year Stormwater Monitoring Record
McCall Oil and Chemical

Sampling Station	n (count)	r^2	T statistic	T 95%	Significant?	Trend	Exponential Decay Model (Linear Model in Log base 10)	% Reduction in 10 years
TSS								
S-1	31	0.21	2.24	2.05	YES	DOWN	y = -0.0619 x + 6.6336	76.0%
S-3	35	0.40	4.94	2.03	YES	DOWN	y = -0.0509 x + 7.7158	69.0%
Oil & Grease								
S-1	31	0.008	0.22	2.05	NO			
S-3	33	0.022	1.53	2.04	NO			
OWS	378	0.005	1.22	1.97	NO			
COD								
S-1	13	0.17	1.18	2.20	NO			
S-3	16	0.17	3.47	2.14	YES	DOWN	y = -0.0619 x + 7.8030	76.0%
Copper								
S-1	31	0.16	1.49	2.05	NO		y = -0.0438 x + 2.8979	63.5%
S-3	35	0.31	4.77	2.03	YES	DOWN	y = -0.0798 x + 6.9264	84.1%
Lead								
S-1	31	0.45	4.88	2.05	YES	DOWN	y = -0.1100 x + 9.5519	92.1%
S-3	35	0.46	5.34	2.03	YES	DOWN	y = -0.1104 x + 9.7236	92.1%
Zinc								
S-1	30	0.15	1.90	2.05	(at 93%)	(DOWN)	y = -0.0336 x + 2.6384	53.9%
S-3	34	0.09	1.99	2.04	(at 94%)	(DOWN)	y = -0.0294 x + 2.3822	49.2%

Table 9
Comparison of Site Stormwater with Portland Harbor Industrial Stormwater
McCall Oil and Chemical

	Portland Harbor Stormwater			Site Stormwater Concentrations																				
	50th %-ile Heavy Industrial	Mean Heavy Industrial	90th %-il Heavy Industrial	Mean Site-Wide	S-1 12/20/00	S-1 03/06/02	S-1 04/07/05	S-1 11/12/07	S-2 12/20/00	S-2 03/06/02	S-2 04/07/05	S-2 05/02/07	S-2 11/12/07	S-3 12/15/00	S-3 03/06/02	S-3 04/07/05	S-3 05/02/07	S-3 11/12/07	S-4 12/15/00	S-4 Dupe 12/15/00	S-4 04/09/02	S-4 04/07/05	S-4 05/02/07	S-4 11/12/07
Metals (ug/L)																								
Arsenic - Total	1.1	3.2	9.2	0.51	0.5 U	0.5 U	0.5 U	**0.7**	1 U	0.5 U	0.5 U	0.5 U	**0.8**	1 U	0.5 U	0.5 U	0.5 U	**0.7**	--	--	**0.6**	**0.5**	**1.5**	**1.1**
Arsenic - Dissolved	0.64	2.2	3.2	0.35	--	--	0.5 U	0.5 U	--	--	--	0.5 U	**0.6**	--	--	0.5 U	0.5 U	**0.5**	0.5 U	0.5 U	--	0.5 U	0.5 U	**0.8**
Cadmium - Total	0.42	1.4	1.5	0.23	0.05 U	0.20 U	**0.16**	**0.21**	**0.22**	0.20 U	**0.07**	**0.12**	**0.30**	--	0.2 U	**1.1**	**0.17**	**0.17**	--	--	**0.20**	**0.19**	**0.51**	**0.21**
Cadmium - Dissolved	0.19	0.31	0.70	0.21	--	--	**0.07**	**0.07**	--	--	**0.05**	**0.05**	**0.10**	**0.63**	--	**0.96**	**0.15**	**0.15**	**0.22**	**0.21**	--	**0.09**	**0.16**	**0.01**
Chromium - Total	3.8	21	44	2.1	**0.4**	**0.4**	**7.0**	**2.3**	**2.0**	**0.6**	**1.1**	**1.1**	**5.5**	--	**1.2**	**1.9**	**2.3**	**1.6**	--	--	**0.9**	**1.1**	**5.2**	**1.5**
Chromium - Dissolved	0.81	1.7	4.5	0.90	--	--	**1.3**	**0.5**	--	--	**0.7**	**0.7**	**0.8**	**2.9**	--	**1.3**	**0.9**	**0.9**	**0.8**	**0.6**	--	**0.2**	**0.50**	**0.50**
Copper - Total	27	74	187	14	**3.8**	**3.7**	**14**	**20**	**9.9**	**10**	**9.4**	**11.3**	**25.9**	--	**13.1**	**8.6**	**19**	**24**	--	--	--	**8.3**	**28**	**15**
Copper - Dissolved	7.9	17	39	10	--	--	**7.9**	**9.6**	--	--	**6.0**	**8.8**	**8.3**	**30**	--	**7.1**	**13**	**18**	**4.9**	**4.7**	**9.0**	**4.4**	**14**	**11**
Lead - Total	15	82	99	8.5	**0.43**	**0.31**	**27**	**10**	**5.9**	**1.1**	**2.3**	**3.2**	**24**	--	**2.3**	**4.1**	**4.9**	**4.0**	--	--	**3.3**	**6.2**	**36**	**9.9**
Lead - Dissolved	0.53	1.8	5.3	0.65	--	--	**0.61**	**0.32**	--	--	**0.7**	**0.86**	**1.1**	**1.6**	--	**1.1**	**0.75**	**0.90**	**0.05**	**0.04**	--	**0.09**	**0.54**	**0.39**
Zinc - Total	235	610	1,532	170	**200**	**195**	**87**	**154**	**113**	**73**	**51**	**149**	**353**	--	**84**	**189**	**375**	**334**	--	--	**87**	**90**	**252**	**103**
Zinc - Dissolved	85	228	435	161	--	--	**48**	**92**	--	--	**43**	**101**	**184**	**596**	--	**182**	**301**	**312**	**47.1**	**45**	--	**46.8**	**201**	**59**
Low Molecular Weight PAHs (ug/L)					LPAHs																			
Naphthalene	0.03	0.10	0.11	0.02	**0.03** J	**0.03** J	**0.03** J	**0.03** J	**0.07** J	**0.03** J	0.01 U	**0.02**	**0.02**	**0.07** J	**0.03** J	0.01 U	**0.01**	0.02 U	**0.04** J	**0.04** J	0.01 U	0.01 U	0.02 Ui	0.02 U
Acenaphthylene	0.01	0.03	0.08	0.02	**0.01** J	0.01 U	**0.04** J	0.02 U	**0.02** J	0.01 U	**0.03** J	**0.02** D	0.02 U	0.10 U	0.01 U	0.01 U	0.01 Ui	0.02 U	0.10 U	0.10 U	0.01 U	0.01 U	0.01 U	0.02 U
Acenaphthene	0.02	0.03	0.08	0.03	**0.02** J	0.01 U	0.01 U	0.02 UJ	**0.02** J	0.01 U	0.01 U	0.02 U	0.02 U	0.10 U	0.01 U	0.01 U	0.01 U	0.02 U	**0.14**	**0.12**	**0.09** J	0.01 U	0.01 U	0.02 U
Fluorene	0.02	0.03	0.07	0.05	**0.02** J	0.01 U	**0.03** J	0.02 UJ	**0.04** J	0.01 U	0.01 U	0.02 U	0.02 U	**0.02** J	0.01 U	0.01 U	**0.01**	0.02 U	**0.36**	**0.34**	**0.17** J	0.01 U	0.01 U	0.02 U
Phenanthrene	0.11	0.22	0.47	0.10	**0.07** J	**0.03** J	**0.19** J	**0.07** J	**0.25**	**0.04** J	**0.05** J	**0.03**	**0.04**	**0.20**	**0.05** J	**0.06** J	**0.02**	**0.03**	**0.46**	**0.35**	**0.07** J	**0.03** J	0.03 Ui	0.02 U
Anthracene	0.03	0.05	0.14	0.01	0.01 U	0.02 U	**0.04** J	0.02 UJ	**0.02** J	0.02 U	0.02 U	0.01 U	0.02 U	0.10 U	0.02 U	0.02 U	0.01 U	0.02 U	**0.02** J	**0.01** J	0.02 U	0.02 U	0.01 U	0.02 U
2-Methylnaphthalene	0.01	0.04	0.10	0.02	**0.03** J	**0.02** J	0.01 U	0.02 UJ	**0.05** J	**0.01** J	0.01 U	0.01 U	0.02 U	**0.10**	0.01 U	0.01 U	0.01 U	0.02 U	**0.09** J	**0.10**	0.01 U	0.01 U	**0.01**	0.02 U
High Molecular Weight PAHs (ug/L)					HPAHs																			
Fluoranthene	0.14	0.49	1.38	0.05	**0.02** J	0.01 U	**0.23**	**0.09** J	**0.10**	**0.02** J	**0.06** J	**0.02**	**0.03**	**0.06** J	**0.02** J	**0.04** J	**0.02**	0.02	**0.06** J	**0.05** J	0.01 U	0.01 U	**0.05**	0.02 U
Pyrene	0.14	0.45	1.09	0.07	**0.02** J	0.02 U	**0.28**	**0.08** J	**0.12**	**0.03** J	**0.06** J	**0.02**	**0.03**	**0.03** J	**0.02** J	**0.04** J	**0.02**	0.02 U	**0.19**	**0.16**	**0.10** J	**0.10** J	**0.08**	**0.03**
Benz(a)anthracene	0.048	0.198	0.425	0.015	0.005 U	0.012 U	**0.081** J	**0.031** J	**0.030** J	0.013 U	0.012 U	0.008 U	0.019 U	**0.007** J	0.012 U	0.012 U	0.008 U	0.019 U	**0.030** J	**0.020** J	0.012 U	0.012 U	**0.012**	0.020 U
Chrysene	0.082	0.344	0.729	0.032	**0.008** J	0.014 U	**0.140** J	**0.066** J	**0.060** J	0.015 U	0.014 U	0.008 U	0.019 U	**0.030** J	0.015 U	0.014 U	**0.009**	0.019 U	**0.120**	**0.090** J	0.014 U	0.014 U	**0.030**	0.020 U
Benzo(b)fluoranthene	0.076	0.400	0.770	0.024	**0.006** J	0.020 U	**0.150** J	**0.065** J	**0.040** J	0.021 U	**0.021** J	0.008 U	0.019 U	**0.010** J	0.020 U	0.020 U	0.008 U	0.019 U	**0.030** J	**0.030** J	0.020 U	0.020 U	**0.034**	0.020 U
Benzo(k)fluoranthene	0.027	0.136	0.259	0.013	**0.004** J	0.020 U	**0.049** J	**0.021** J	**0.030** J	0.021 U	0.020 U	0.008 U	0.019 U	**0.008** J	0.020 U	0.020 U	0.008 U	0.019 U	**0.020** J	**0.010** J	0.020 U	0.020 U	0.0077 U	0.020 U
Benzo(a)pyrene	0.044	0.232	0.470	0.019	0.006 U	0.016 U	**0.100** J	**0.031** J	**0.030** J	0.017 U	0.020 U	0.008 U	0.019 U	0.095 U	0.017 U	0.016 U	0.008 U	0.019 U	**0.030** J	**0.020** J	0.016 U	0.016 U	**0.017**	0.020 U
Indeno(1,2,3-cd)pyrene	0.048	0.284	0.579	0.018	**0.006** J	0.024 U	**0.089** J	**0.035** J	**0.040** J	0.026 U	0.020 U	0.008 U	0.019 U	**0.010** J	0.025 U	0.024 U	0.008 U	0.019 U	**0.020** J	**0.020** J	0.024 U	0.024 U	**0.020**	0.020 U
Dibenz(a,h)anthracene	0.012	0.065	0.119	0.015	0.004 U	0.031 U	0.031 U	0.020 UJ	**0.009** J	0.032 U	0.020 U	0.008 U	0.019 U	0.190 U	0.031 U	0.031 U	0.008 U	0.019 U	**0.009** J	**0.008** J	0.031 U	0.031 U	0.0077 U	0.020 U
Benzo(g,h,i)perylene	0.052	0.273	0.568	0.023	**0.007** J	0.017 U	**0.140** J	**0.041** J	**0.060** J	0.018 U	0.020 U	0.009	0.019 U	**0.010** J	0.017 U	0.017 U	0.008 U	0.019 U	**0.040** J	**0.030** J	0.017 U	0.017 U	**0.027**	0.020 U
Miscellaneous Semivolatiles					SVOCs																			
3- and 4-Methylphenol	0.25	1.4	4.8	0.19	**0.30** J	**0.23** J	0.05 U	0.50 U	**0.49**	**0.09** J	0.05 U	0.48 U	0.50 U	0.48 U	**0.22** J	**0.12** J	0.48 U	0.49 U	**0.20** J	**0.20** J	0.05 U	0.05 U	0.48 U	0.47 U
Di-n-butyl Phthalate	0.24	0.49	1.38	0.15	--	--	--	0.20 U	--	--	--	**0.21**	**0.35**	--	--	--	0.20 U	0.20 U	--	--	--	--	0.20 U	0.19 U
Butyl Benzyl Phthalate	0.26	0.31	0.62	0.10	**0.10** J	**0.19** J	0.20	0.20 U	**0.10** J	**0.05** J	**0.08** J	0.20 U	0.20 U	**0.08** J	**0.09** J	**0.09** J	0.20 U	0.20 U	**0.05** J	**0.04** J	**0.14** J	**0.10** J	0.20 U	0.19 U
Bis(2-ethylhexyl) Phth.	1.5	2.5	7.3	1.78	--	--	--	0.99 U	--	--	--	**1.4**	**6.7**	--	--	--	0.96 U	**2.4**	--	--	--	--	0.96 U	0.94 U
Di-n-octyl Phthalate	0.03	0.30	0.89	0.12	0.003 U	0.03 U	0.03 U	0.20 U	0.003 U	0.03 U	**0.11** J	0.20 U	0.20 U	0.95 U	0.03 U	0.03 U	0.20 U	0.20 U	0.95 U	0.96 U	0.032 U	0.032 U	0.20 U	0.19 U
Total Petroleum Hydrocarbons (mg/L)																								
Gasoline Range	--	--	--	0.23	**1.1** Z	0.11 U	0.1 U	0.25 U	0.1 U	**0.13** Z	0.1 U	0.25 U	0.25 U	**1.3** Z	0.11 U	**0.12** Z	0.25 U	0.25 U	**0.27** Z	**0.26** Z	**0.22** H	0.1 U	0.25 U	0.25 U
Diesel Range	--	--	--	0.38	0.1 U	0.11 U	**0.34** H	**0.33** H	0.1 U	0.11 U	**0.31** Y	0.25 U	**0.5** H	**0.51** Z	**0.11** Z	**0.55** Y	**0.29** Z	**0.29** Y	**0.28** Z	**0.3** Z	**1.3** F	**0.44** Y	**1** Z	**0.74** Y
Residual Oil Range	--	--	--	0.42	0.25 U	0.27 U	**0.88** O	**0.61** O	0.25 U	0.26 U	**0.43** O	0.5 U	**1.6** O	0.25 U	0.26 U	**1** O	0.5 U	0.5 U	0.25 U	0.25 U	**0.55** O	**0.34** L	**0.94** Z	0.5 U
Total Petroleum	2.5	5.9	12.5	1.00	**1.1**	0	**1.22**	**0.94**	0	**0.13**	**0.74**	0	**2.1**	**1.81**	**0.11**	**1.67**	**0.29**	**0.29**	**0.55**	**0.56**	**2.07**	**0.78**	**1.94**	**0.74**

Legend:

Concentration greater than average (mean) of heavy industrial stormwater

Concentration greater than 90th percentile of heavy industrial stormwater

Notes:

Bold value = detected concentration; U = Not detected at indicated quantitation limit; J = Estimated concentration; D = The reported result is from a dilution

F = Fingerprint of the sample matches elution pattern of calibration standard; L = Elution pattern indicates the presence of lighter weight constituents

H = Elution pattern indicates the presence of heavier weight constituents; O = Fingerprint resembles oil, but does not match the calibration standard

Y = Fingerprint resembles a petroleum product, but elution pattern does not match calibration standard; Z = Fingerprint does not resemble a petroleum product

Table 10
Comparison of Site Catch Basin Sediment with Portland Harbor Industrial Sites
McCall Oil and Chemical

	Portland Harbor Storm Sediment			Stormwater Catch Basin Sediment								Outfall
	50th %-ile Heavy Industrial	Mean Heavy Industrial	90th %-ile Heavy Industrial	Mean Site-Wide	S-1 Sediment 12/15/00	S-1 Sediment 11/12/07	S-2 Sediment 12/15/00	S-2 Sediment 11/12/07	S-3 Sediment 12/15/00	S-3 Sediment 11/04/04	S-3 Sediment 05/02/07	S3-01C Sediment 12/15/00
Metals (mg/kg)												
Arsenic	14	19	47	14	**5.2**	**4.4**	**7.5**	**4.6**	**38**	**26**	**10**	**4.4**
Cadmium	3.5	3.7	6.8	1.8	**2.0**	**1.8**	**1.4**	**1.1**	**2.9**	**1.9**	**1.6**	**0.12**
Chromium	73	145	253	106	**49**	**122**	**64**	**95**	**144**	**189**	**79**	**12**
Copper	161	6,110	6,511	502	**137**	**214**	**316**	**115**	**1,050**	**1,360**	**321**	**27**
Lead	192	305	817	312	**145**	**312**	**211**	**256**	**454**	**600**	**206**	**8.6**
Mercury	0.17	0.32	0.45	0.17	--	**0.08**	--	**0.20**	--	--	**0.24**	--
Nickel	44	54	93	45	--	**52**	--	**39**	--	--	**44**	--
Zinc	1,220	3,180	3,873	868	**638**	**1,550**	**584**	**630**	**985**	**752**	**938**	**83**
Low Molecular Weight PAHs (ug/kg)												
Naphthalene	115	1,040	1,200	201	**200** JD	**270**	**50** JD	**290**	**400** JD	**64** JD	**130**	12 U
Acenaphthylene	95	714	590	37	**40** JD	**42**	**20** JD	**28**	**60** JD	37 JU	**31**	12 U
Acenaphthene	290	1,024	2,200	127	**200** JD	**230**	**30** JD	**21**	720 U	26 JU	**24**	12 U
Fluorene	140	1,110	1,600	571	**100** JD	**130**	**20** JD	**26**	**3,600** D	**72** JD	**47**	12 U
Phenanthrene	3,700	12,887	13,000	1,146	**1,500** D	**950**	**320** D	**320**	**3,600** D	**660** JD	**670**	12 U
Anthracene	1,000	3,226	2,300	505	**400** JD	**230**	**50** JD	**56**	**2,600** D	**140** JD	**58**	12 U
2-Methylnaphthalene	85	805	1,100	125	**100** JD	**180**	**50** JD	**33**	**400** JD	31 JU	**80**	**1** J
High Molecular Weight PAHs (ug/kg)												
Fluoranthene	10,000	16,884	33,000	1,904	**2,600** D	**1,400**	**690** D	**660**	**5,800** D	**1,400** JD	**780**	**3** J
Pyrene	8,000	21,228	33,000	1,859	**2,600** D	**1,300**	**770** D	**640**	**5,500** D	**1,200** JD	**1,000**	**3** J
Benz(a)anthracene	3,100	8,124	22,000	794	**1,300** D	**470**	**440** D	**220**	**2,500** D	**400** JD	**230**	**2** J
Chrysene	4,000	12,037	28,000	1,561	**2,000** D	**880**	**740** D	**520**	**5,300** D	**1,100** JD	**390**	**3** J
Benzo(b)fluoranthene	5,800	14,690	43,000	1,461	**2,000** D	**930**	**780** D	**750** X	**4,100** D	**1,100** JD	**570**	**3** J
Benzo(k)fluoranthene	2,100	4,434	14,000	885	**1,500** D	**300**	**540** D	6 U	**3,400** D	**270** JD	**180**	**2** J
Benzo(a)pyrene	4,500	10,463	31,000	1,136	**1,900** D	**540**	**670** D	**330**	**3,700** D	**490** JD	**320**	**2** J
Indeno(1,2,3-cd)pyrene	3,600	10,241	27,000	1,027	**1,500** D	**570**	**490** D	**400**	**3,200** D	**530** JD	**500**	**2** J
Dibenz(a,h)anthracene	690	1,861	5,300	231	**300** JD	**88**	**100** JD	**78**	**800** JD	**150** JD	**100**	24 U
Benzo(g,h,i)perylene	3,400	9,672	25,000	1,299	**1,600** D	**810**	**500** D	**690**	**3,600** D	**790** JD	**1,100**	**3** J
Miscellaneous Semivolatiles (ug/kg)												
3- and 4-Methylphenol	1,300	3,800	6,300	NC	13,000 U	650 UJ	1,900 U	**7,100** J	**4,000** JD	**3,000** JD	680 U	240 U
Dibenzofuran	135	393	1,200	82	**100** JD	**100** JD	**20** JD	**20** JD	**200** JD	**69** JD	**67**	12 U
Di-n-butyl Phthalate	390	678	1,900	NC	--	1,300 UJ	--	1,300 UJ	--	--	**840** D	--
Butyl Benzyl Phthalate	350	989	2,200	2,724	**1,500** D	**1,200** J	**2,500** D	**7,600** J	**5,000** D	**930** JD	680 U	**1** J
Bis(2-ethylhexyl) Phth.	18,000	25,824	48,000	9,900	--	**8,700** J	--	**9,000** J	--	--	**12,000** D	--
Di-n-octyl Phthalate	60	176	265	NC	13,000 U	13,000 UJ	1,900 U	1,300 UJ	14,000 U	**11,000** JD	680 U	**2** J
Polychlorinated Biphenyls (ug/kg)												
Total PCBs	1,380	1,380	1,612	100	--	**126**	--	**30**	--	--	**144**	--
Total Petroleum Hydrocarbons (mg/kg)												
Gasoline	10	27	38	107	**26** Y	13 U	**21** Y	13 U	**580** Y	210 U	14 U	10 U
Diesel	404	1361	2604	1,141	**400** H	**590** DH	**300** H	**1,300** DH	**2,400** H	**1,600** JH	**1,400** DH	10 U
Residual Oil	4415	6252	14300	6,443	**1,900** O	**4,600** DO	**2,200** DO	**11,000** DO	**7,600** DO	**8,500** JO	**9,300** DO	**30** Y

Legend:

(yellow)	Concentration greater than average (mean) of heavy industrial stormwater
(blue)	Concentration greater than 90th percentile of heavy industrial stormwater
NC	Site-wide mean not calculated due to insufficient detections

Notes:

NC = Not calculated due to insufficient detections

Bold value = detected concentration; U = Not detected at indicated limit

J = Estimated concentration; D = Dilution of sample required

Table 11
Source Control Screening Evaluation Summary
McCall Oil and Chemical

	Concentrations less than Background Levels?	Concentrations less than Ecological SLVs? (See Tables 5, 6, 7)	Site Average Concentrations below Human Health SLVs? (see Tables 5, 6, 7)	SCMs Implemented and Effective? (see Table 8)	Concentrations Similar/ Lower than Comparable Sites? (see Tables 9, 10)	Lack of Evidence of Impacts to Willamette River? (see Table 3)
	1A	1B	1C	2	3	4
STORMWATER						
Metals						
Arsenic	YES					
Cadmium	YES					
Chromium	YES					
Copper	NO	NO	YES	YES	YES	
Lead	NO	NO	YES	YES	YES	
Manganese	YES (a)					
Mercury	N/D					
Nickel	YES (b)					
Silver	YES					
Zinc	NO	NO	YES	YES	YES	YES
Organics						
LPAHs	n/a	YES	YES			
HPAHs	n/a	YES	NO	YES (d)	YES	YES
Dibenzofuran	n/a	YES	YES			
DEHP	n/a	YES (c)	YES	YES (d)	YES	YES
Other Phthalates	n/a	YES	YES			
PCBs	n/a	N/D	N/D			
TPH	n/a	YES (e)	YES (e)			
GROUNDWATER						
Metals						
Arsenic	NO	YES	NO	n/a	YES (m)	YES
Chromium	NO	YES (f)	YES			
Copper	NO	YES (f)	YES			
Organics						
LPAHs	n/a	YES	YES			
HPAHs	n/a	YES	NO	n/a	n/a	YES
Dibenzofuran	n/a	YES	YES			
Phthalates	n/a	YES	YES			
VOCs	n/a	n/a	YES (g)			
CATCH BASIN SEDIMENT						
Metals						
Arsenic	NO	NO	NO	YES (d)	YES	YES
Cadmium	NO	YES	NO	YES (d)	YES	
Chromium	NO	NO	n/a	YES (d)	YES	YES
Copper	NO	NO	n/a	YES	YES	YES
Lead	NO	NO	NO	YES	YES	
Manganese	YES					
Mercury	NO	YES	NO	YES (d)	YES	
Nickel	NO	NO	n/a	YES (d)	YES	
Silver	NO	YES	n/a	YES (d)	YES	
Zinc	NO	NO	n/a	YES	YES	YES
Organics						
LPAHs	n/a	NO	n/a	YES (d)	YES (h)	YES
HPAHs	n/a	NO	YES	YES (d)	YES	YES
Dibenzofuran	n/a	n/a	n/a	YES (d)	YES	YES
Phthalates	n/a	YES	NO	YES (d)	YES (i)	YES
PCBs	n/a	YES	NO	YES (d)	YES	YES
TPH	n/a	n/a	n/a	YES (k)		

Table 11
Source Control Screening Evaluation Summary
McCall Oil and Chemical

Notes:

(a) Only 1 in 14 samples (at 169 ug/L) was slightly above background (150 ug/L), and dissolved conc. (46 ug/L) was well below.

(b) Only 1 in 14 samples (at 6.9 ug/L) was slightly above background (5.5 ug/L), and dissolved conc. (2.8 ug/L) was well below.

(c) NRWQC Footnote X: "There is a full set of aquatic life toxicity data that show DEHP is not toxic to aquatic organisms at or below its solubility limit."

(d) Statistically significant reductions in TSS concentrations in site stormwater are expected to reduce the particulate fraction of other contaminants in site runoff, including suspended metals and hydrophobic organics.

(e) Compliance with NPDES permit limit for oil and grease is assumed to be protective of water quality for petroleum.

(f) Well installation was suspected cause of anomalously high concentrations of total metals during first two monitoring events (Oct-01 and Mar-02) at MW-7 and MW-8. Concentrations have since dropped by approximately two orders of magnitude.

(g) Vinyl chloride was detected in only 3 out of 28 samples, at concentrations (0.8 to 1.4 ug/L) that are above the tap water PRG (0.015 ug/L) but below the MCL (2 ug/L) and fish consumption criterion (2.4 ug/L).

(h) Includes one anomalously high fluorene concentration, but site-wide fluorene concentration is still below average.

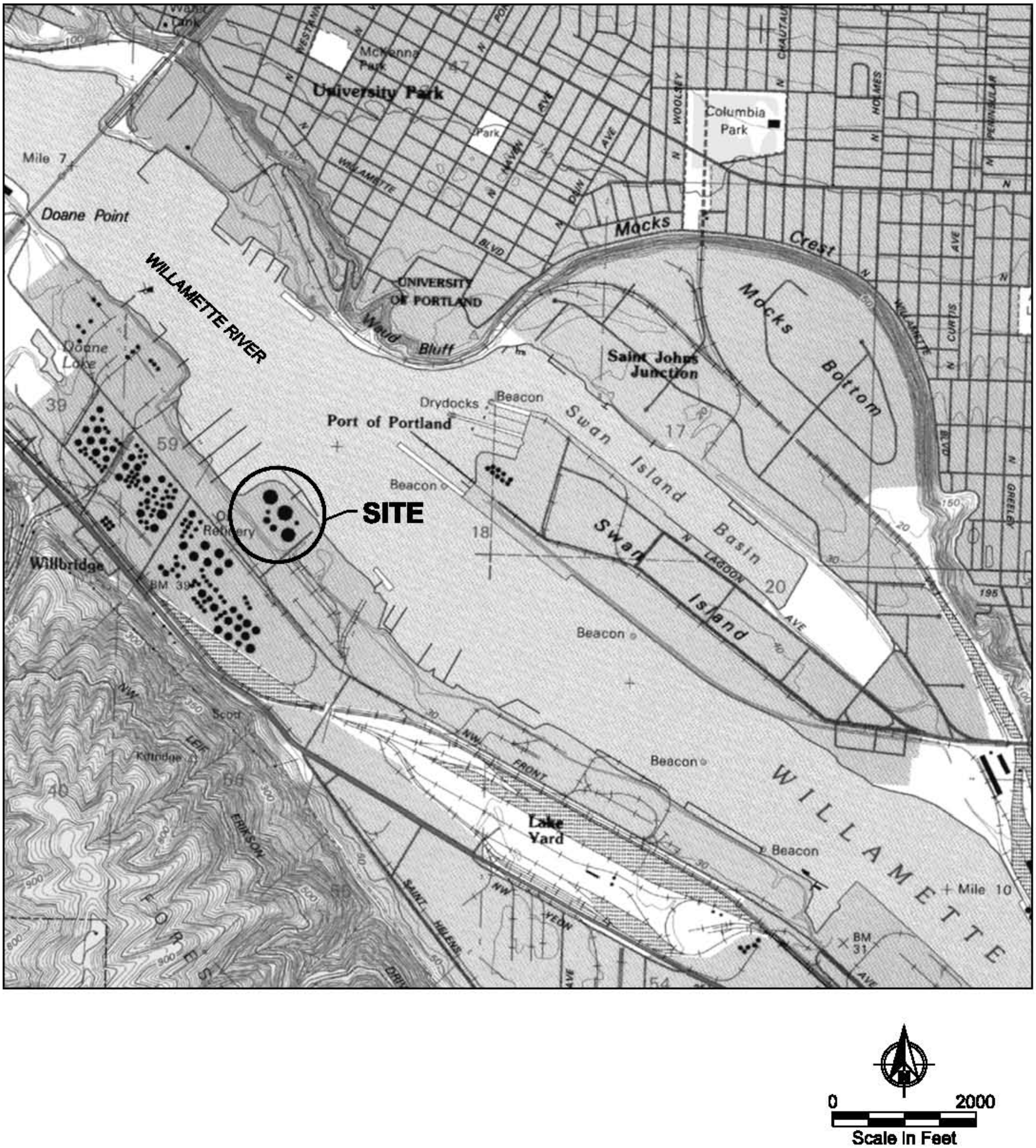
(i) DEHP and Total Phthalate concentrations are below average, although other phthalates are above average.

(k) Oil-water separator installed in tank area, and site stormwater in compliance with NPDES oil and grease limit.

(m) Based on mass loading comparison to Willamette River background load.

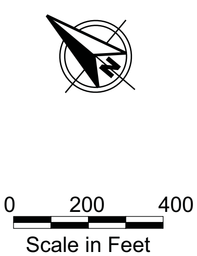
N/D = Not Detected; n/a = Not Applicable

FIGURES



ANCHOR ENVIRONMENTAL, L.L.C.

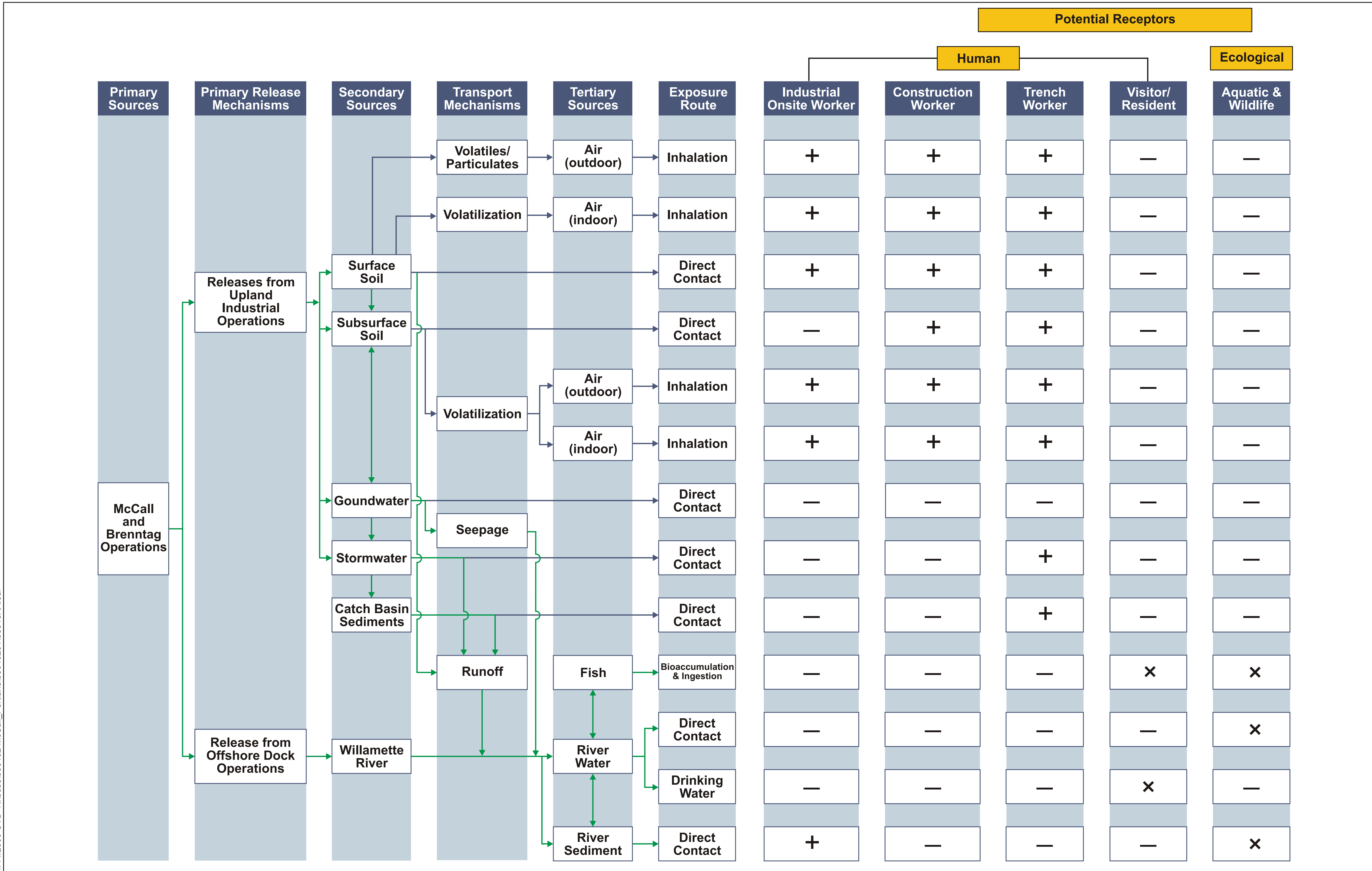
Figure 1
Vicinity Map
McCall Oil and Chemical



* Land use based on 1993
assessment records

ANCHOR
ENVIRONMENTAL, L.L.C.

Figure 2
Land Use Map
McCall Oil
Portland, Oregon



01/14/2009 CVD K:\Jobs\030162-McCall_Portland\03016201\03016AA.cdr

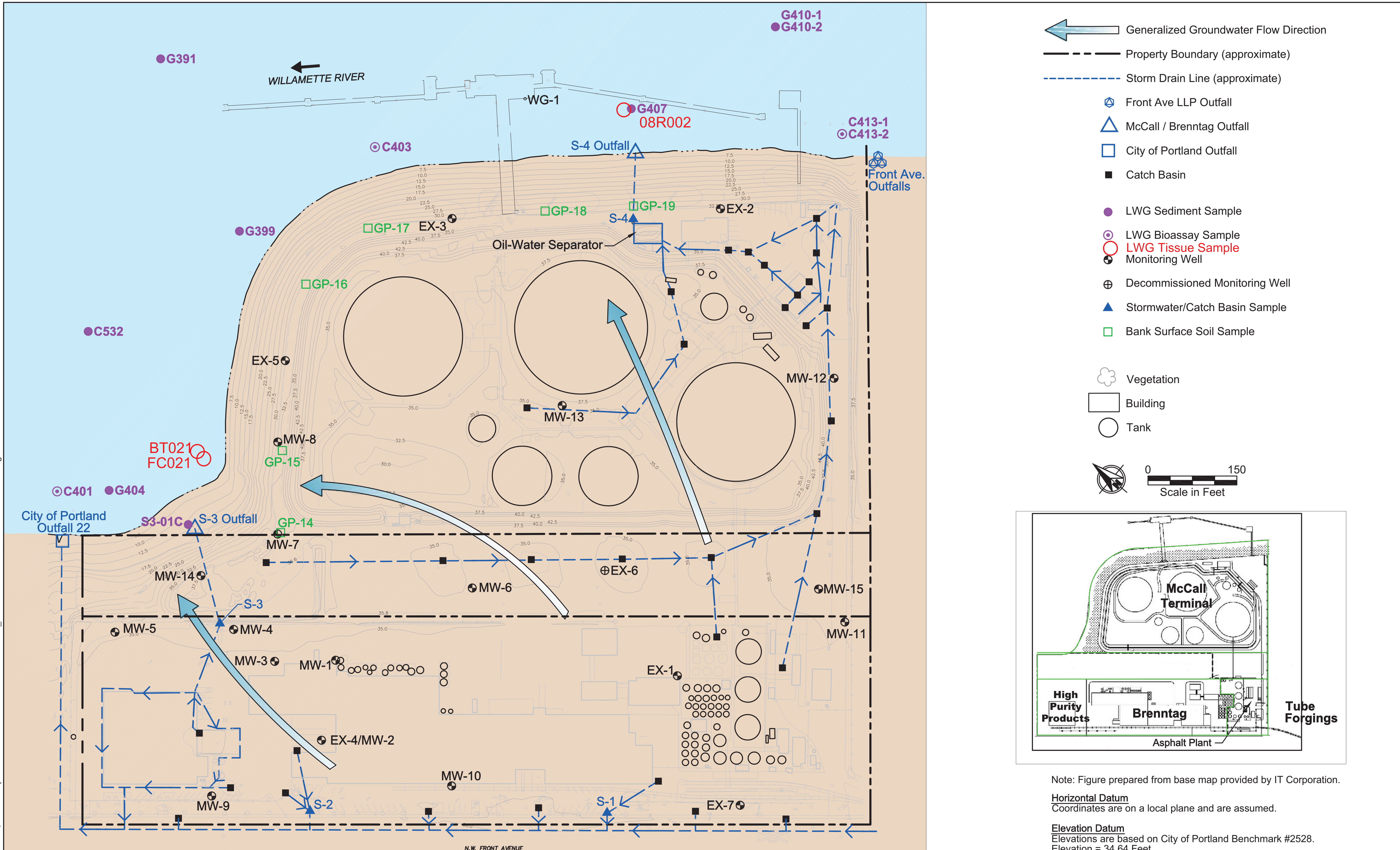
ANCHOR ENVIRONMENTAL, L.L.C.

× Source Control Evaluation Report

+ RI Report

→ Source Control Exposure Pathway

Figure 3
McCall Oil & Chemical Conceptual Site Model



Jan 20, 2009 3:27pm cdavidson K:\Jobs\030162-McCall_Portland\03016201\03016201-RP-001.dwg FIG 4

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 4
Source Control Sample Location Plan
McCall Oil and Chemical

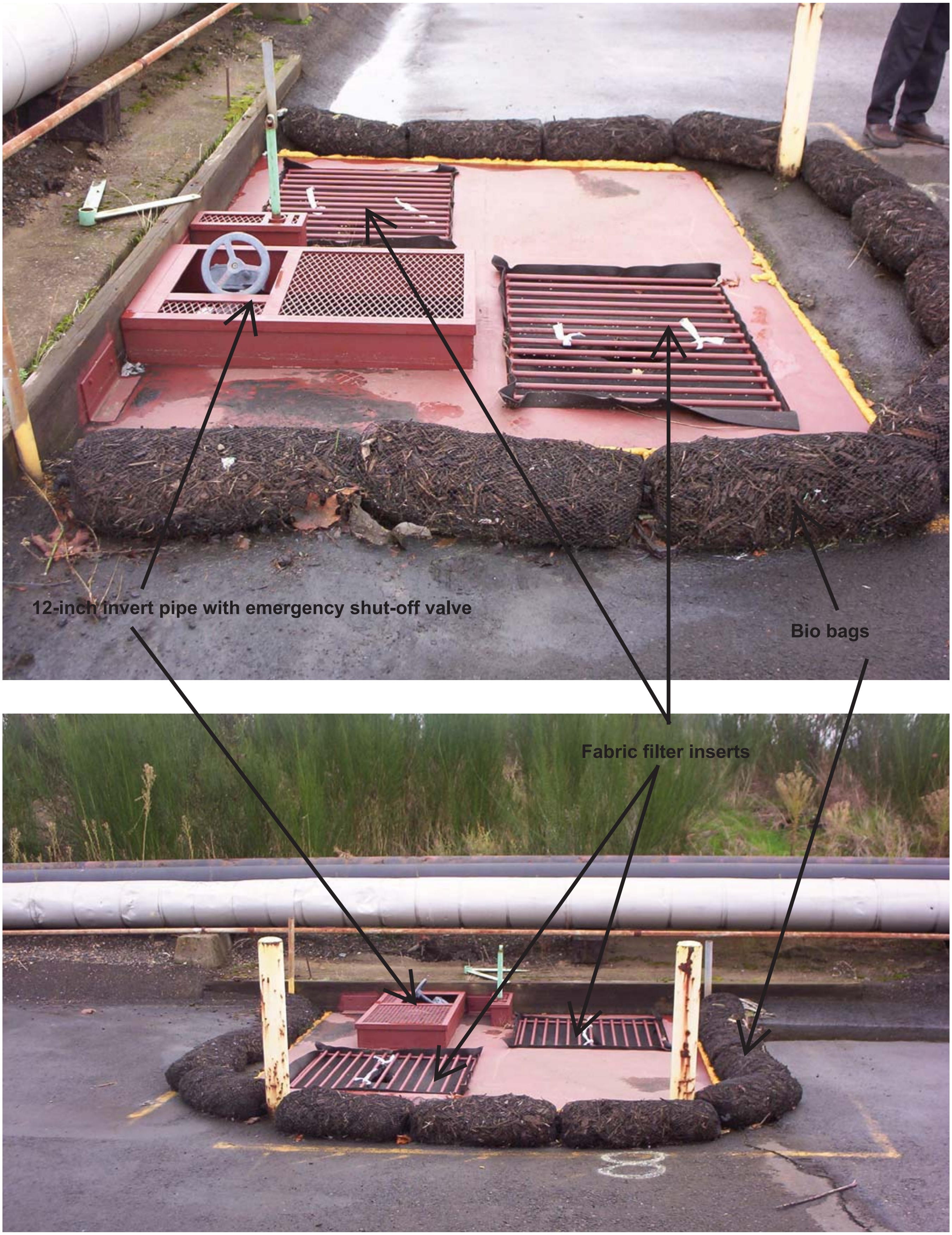
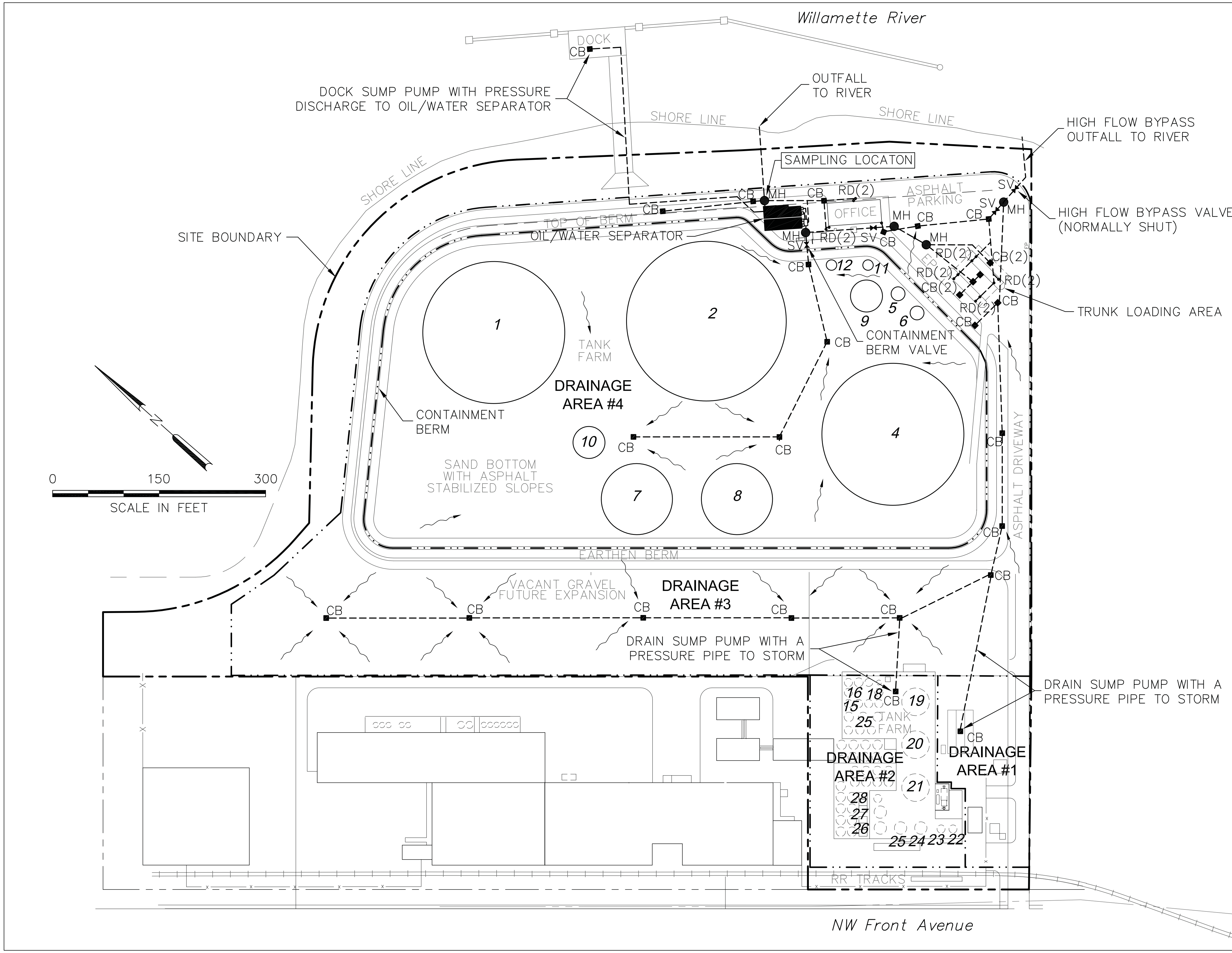


Figure 5
Catch Basin S-3 Retrofit
McCall Oil and Chemical

ANCHOR ENVIRONMENTAL, L.L.C.

APPENDIX A

STORMWATER DRAINAGE BASIN MAPS



LIQUID PRODUCT STORAGE
1=267,790 BARRELS ASPHALT
2=280,650 BARRELS ASPHALT
4=222,808 BARRELS BUNKER
5=647 BARRELS BIODIESEL
6=647 BARRELS BIODIESEL
7=63,303 BARRELS HS DIESEL
8=63,821 BARRELS ULS DIESEL
9=11,176 BARRELS BUNKER
10=11,176 BARRELS HS DIESEL
11=481 BARRELS SLOP OIL
12=239 BARRELS SLOP OIL
15=453 BARRELS FLUX OIL
16= 719 BARRELS FLUX OIL
18=116 BARRELS EMPTY
19=10,184 BARRELS ASPHALT
20=10,190 BARRELS ASPHALT
21=10,191 BARRELS ASPHALT
22=451 BARRELS EMULSION
23=453 BARRELS PIT STOP
24=2,236 BARRELS PITCH
25=2,231 BARRELS PITCH
26=2,219 BARRELS RUBBER
27=2,219 BARRELS RESIN
28=120 BARRELS FUEL
29=272 BARRELS UNICHEM
30=170 BARRELS ACID

DRAINAGE AREAS
1=0.7 ACRES
2=1.2 ACRES
3=8.8 ACRES
4=8.3 ACRES

MH = STORM MANHOLE
CB = STORM CATCH BASIN
RD = ROOF STORM DRAIN
SV = STORM SHUT-OFF VALVE
= DRAINAGE PATTERN
= STORM DRAIN
= DRAINAGE AREA LIMITS

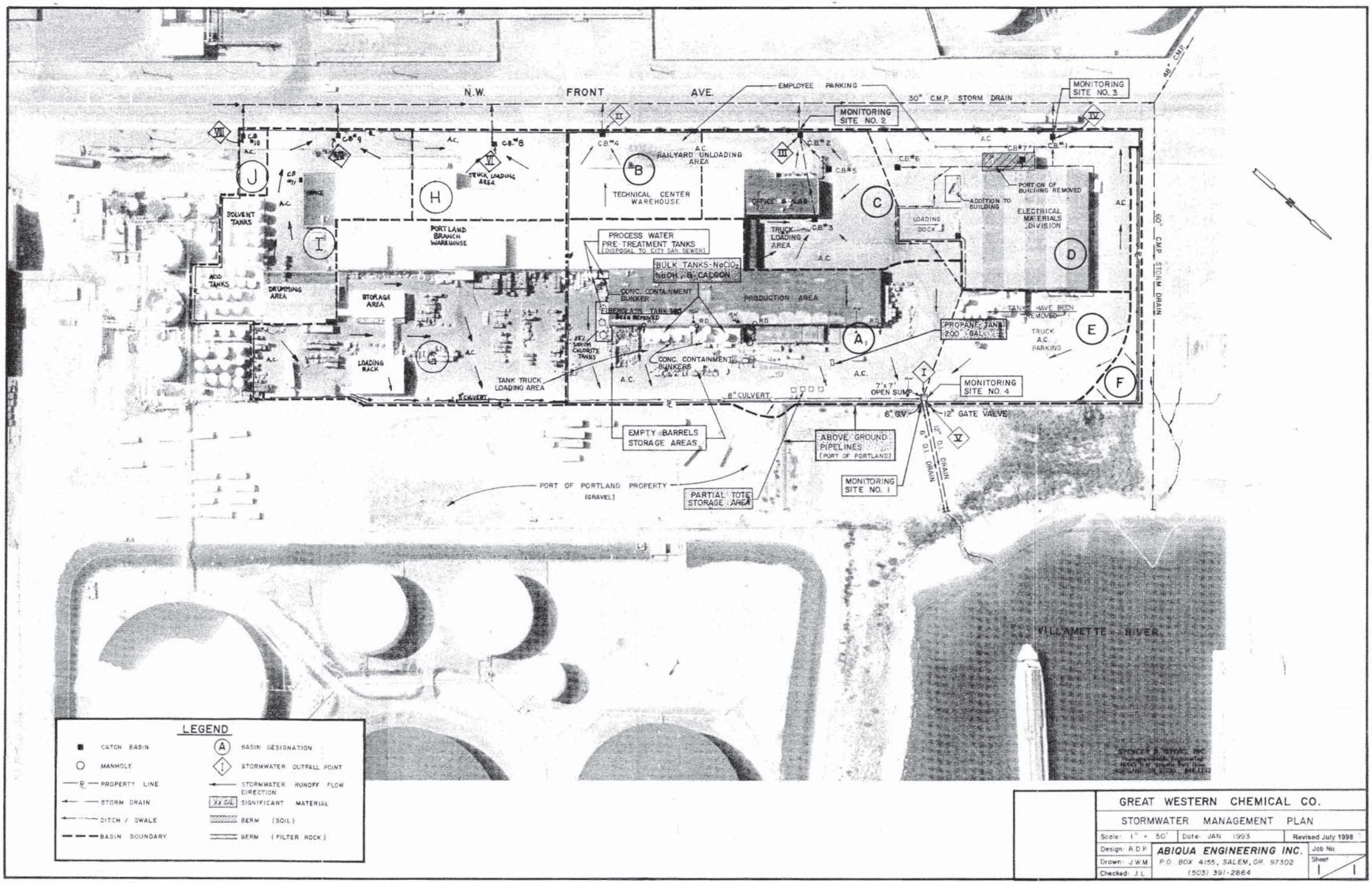
MCCALLSP01 12/28/06

TRT ENGINEERING, INC.
2636 S.E. MARKET STREET
PORTLAND, OREGON 97214
(503) 235-7592

MCCALL OIL AND CHEMICAL CORPORATION
5480 NW FRONT AVENUE
PORTLAND, OREGON
STORMWATER POLLUTION CONTROL PLAN

SITE PLAN

DRAWING NO. 1
PROJECT NO. MC01



N.W. FRONT AVE.
EMPLOYEE PARKING
30" C.M.P. STORM DRAIN
48" CMP
MONITORING SITE NO. 3
MONITORING SITE NO. 2
RAILYARD UNLOADING AREA
TECHNICAL CENTER WAREHOUSE
OFFICE & LAB
TRUCK LOADING AREA
TRUCK LOADING AREA
PORTION OF BUILDING REMOVED
ADDITION TO BUILDING
LOADING DOCK
ELECTRICAL MATERIALS DIVISION
60" CMP STORM DRAIN
SOLVENT TANKS
OFFICE
PORTLAND BRANCH WAREHOUSE
PROCESS WATER PRE-TREATMENT TANKS (DISPOSAL TO CITY SAN SEWER)
BULK TANKS-NaClO₂ NaOH, & CALGON
ACID TANKS
DRUMMING AREA
STORAGE AREA
CONC. CONTAINMENT BUNKER
FIBERGLASS TANK HAS BEEN REMOVED
PRODUCTION AREA
TANKS HAVE BEEN REMOVED
PROPANE TANK 200 GAL.
TRUCK A.C. PARKING
SODIUM CHLORITE TANKS
LOADING RACK
CONC. CONTAINMENT BUNKERS
TANK TRUCK LOADING AREA
7'x7' OPEN SUMP
MONITORING SITE NO. 4
8" CULVERT
8" CULVERT
6" G.V.
12" GATE VALVE
EMPTY BARRELS STORAGE AREAS
ABOVE GROUND PIPELINES (PORT OF PORTLAND)
12" D.I. DRAIN
6" D.I. DRAIN
MONITORING SITE NO. 1
PORT OF PORTLAND PROPERTY (GRAVEL)
PARTIAL TOTE STORAGE AREA
WILLAMETTE RIVER
LEGEND
CATCH BASIN
MANHOLE
PROPERTY LINE
STORM DRAIN
DITCH / SWALE
BASIN BOUNDARY
BASIN DESIGNATION
STORMWATER OUTFALL POINT
STORMWATER RUNOFF FLOW DIRECTION
XX GAL SIGNIFICANT MATERIAL
BERM (SOIL)
BERM (FILTER ROCK)
GREAT WESTERN CHEMICAL CO.
STORMWATER MANAGEMENT PLAN
Scale: 1" = 50'
Date: JAN 1993
Revised July 1998
Design: R.D.P.
Drawn: J.W.M.
Checked: J.L.
ABIQUA ENGINEERING INC.
P.O. BOX 4155, SALEM, OR. 97302
(503) 391-2864
Job No.
Sheet 1 / 1

APPENDIX B

LWG ROUND 2A SEDIMENT AND TISSUE SAMPLE LOCATIONS AND COI DISTRIBUTIONS

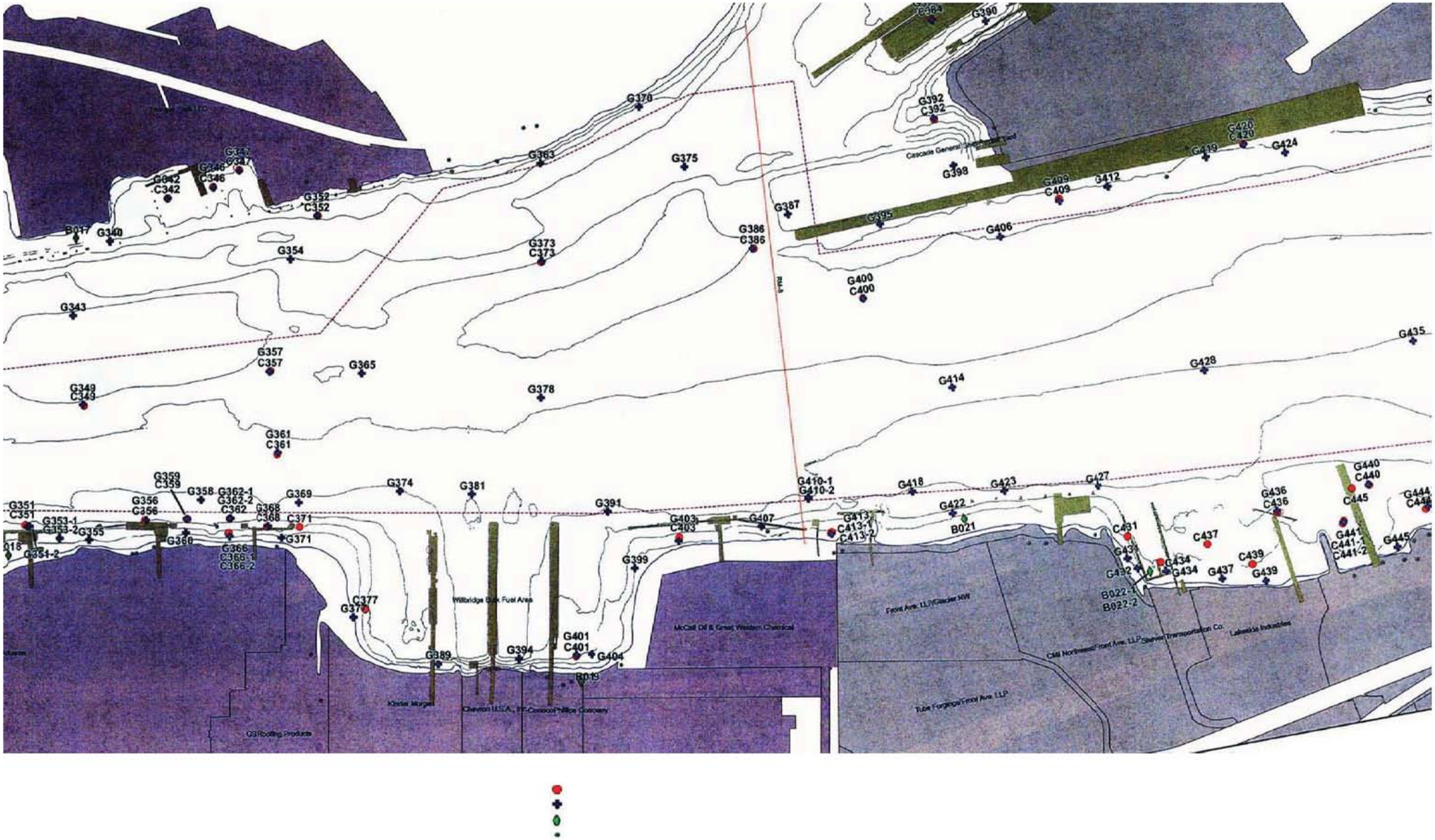

Willbridge Bulk Fuel Area
McCall Oil & Great Western Chemical
Kinder Morgan
Chevron U.S.A., Inc. ConocoPhillips Company
GS Roofing Products
Front Ave. LLP/Glacier NW
Tube Forgings/Front Ave. LLP
Lakeside Industries

Figure B-1

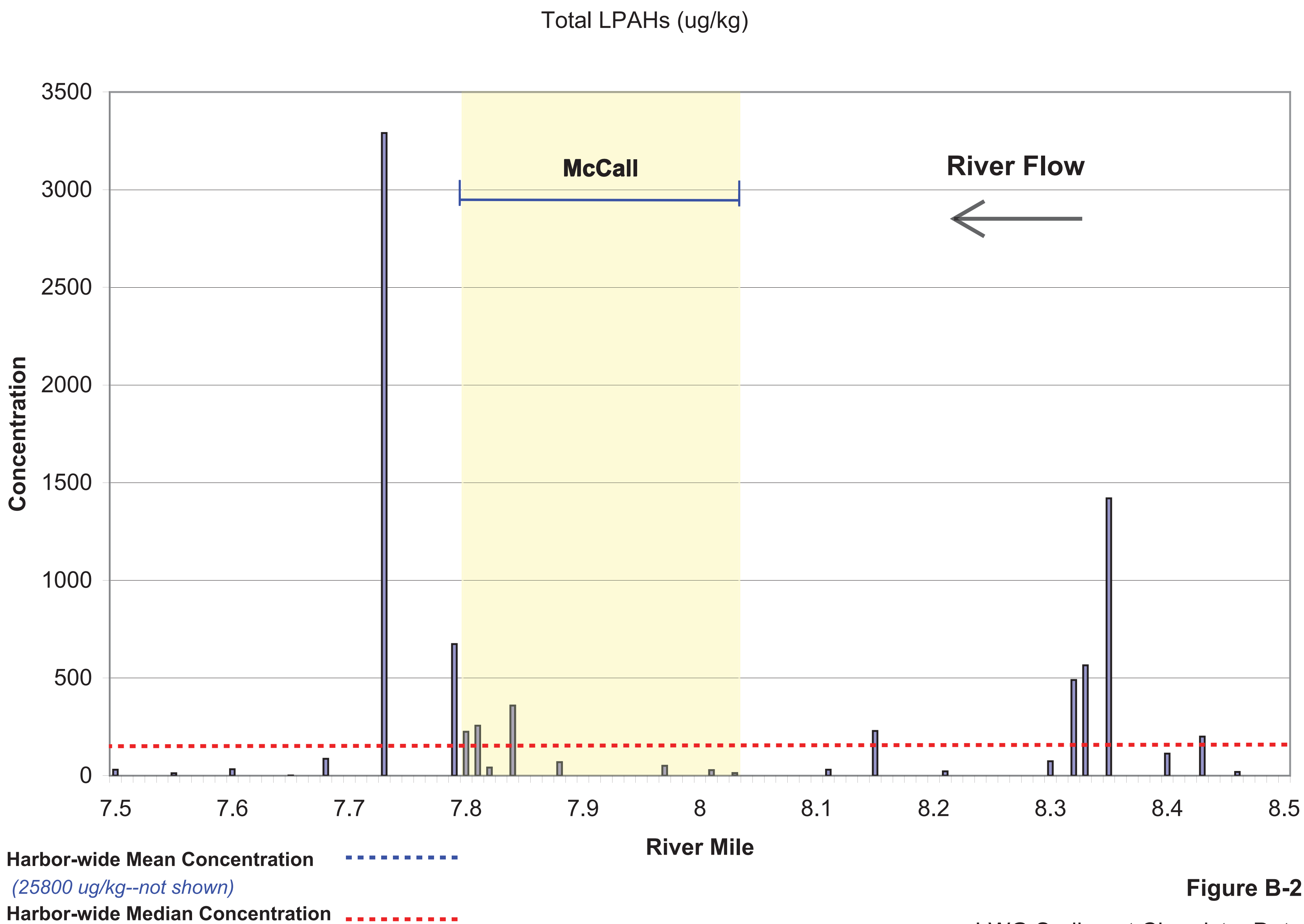


Figure B-2

LWG Sediment Chemistry Data
McCall Oil and Chemical

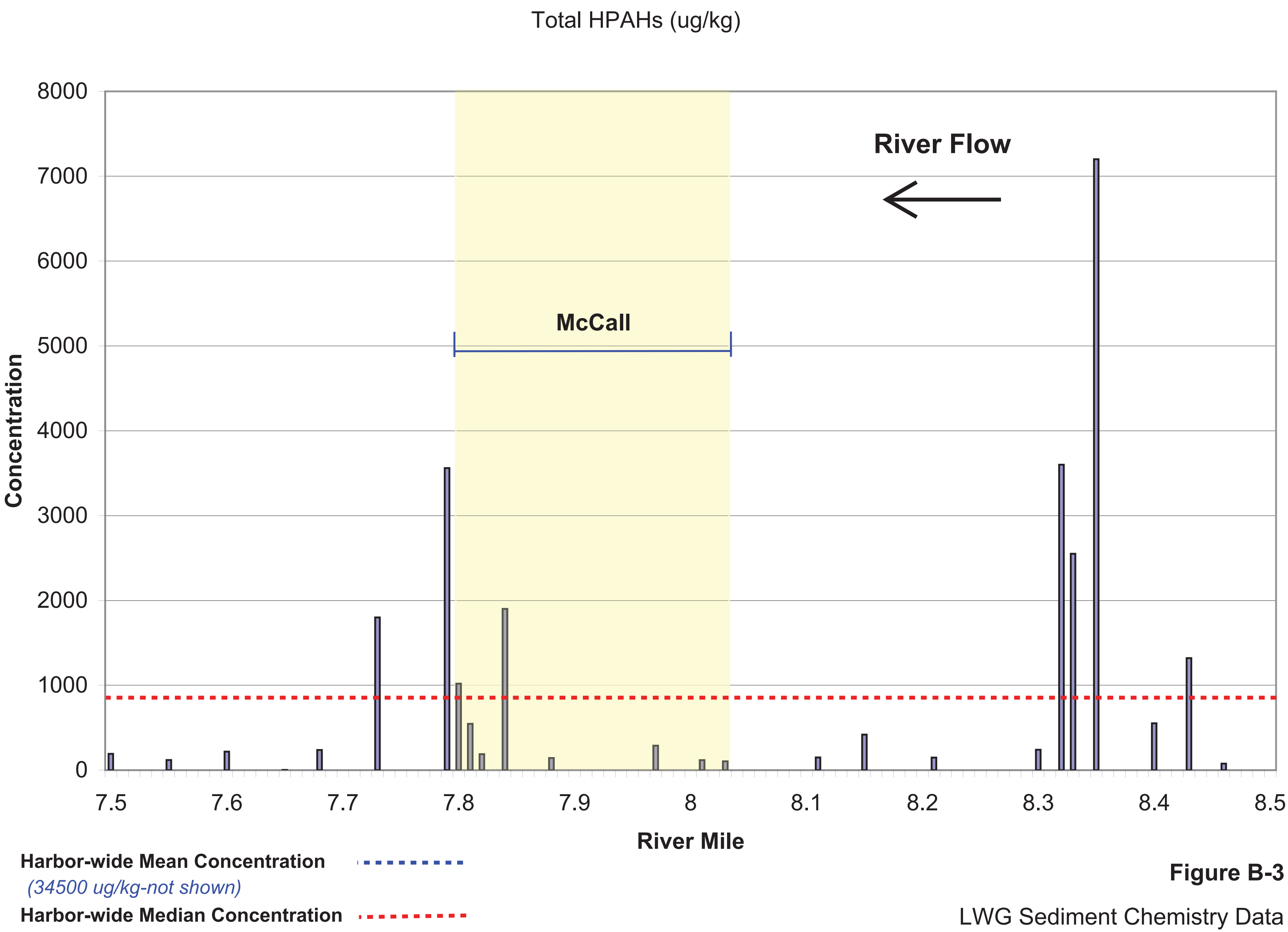


Figure B-3

LWG Sediment Chemistry Data
McCall Oil and Chemical

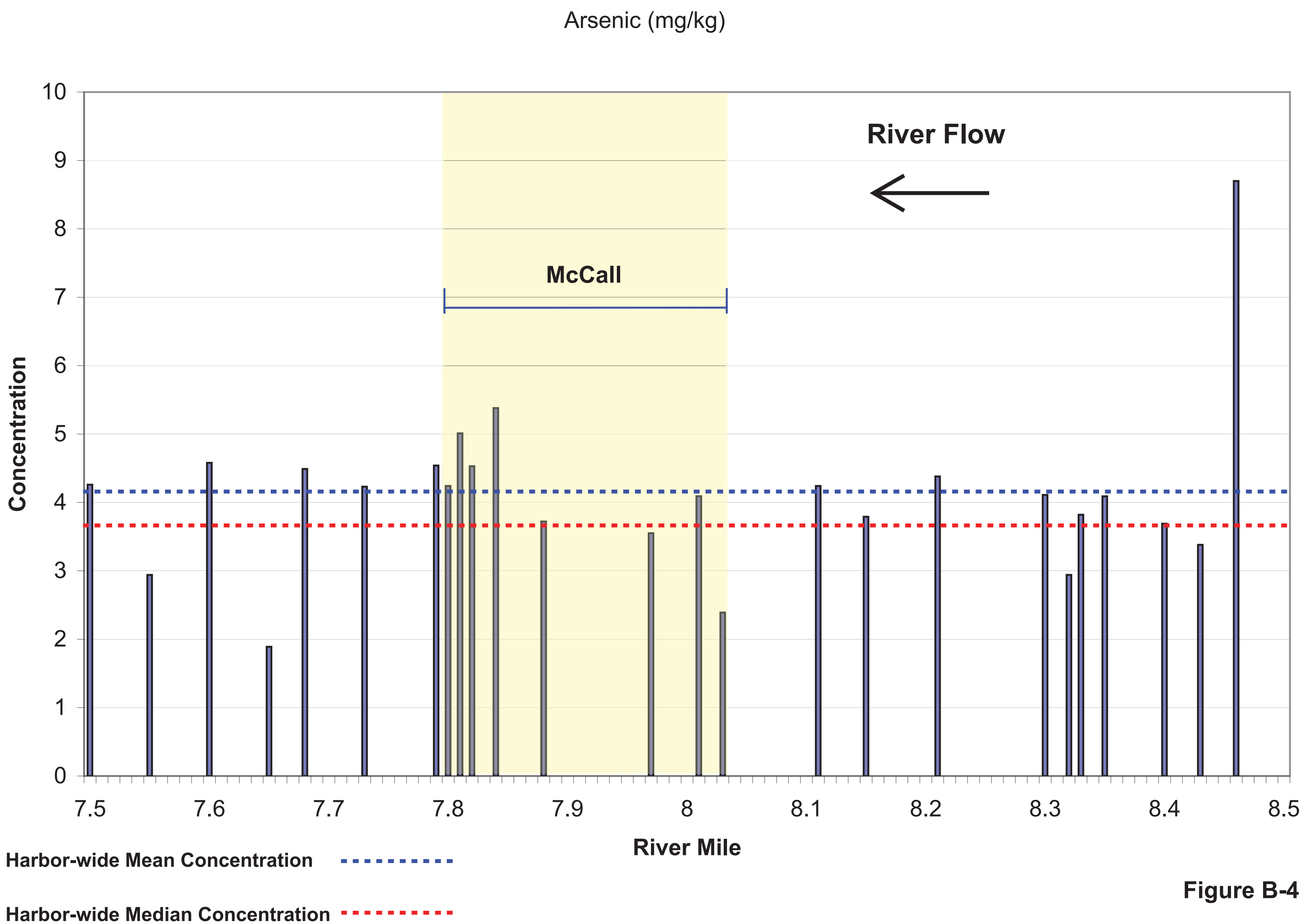


Figure B-4

LWG Sediment Chemistry Data
McCall Oil and Chemical

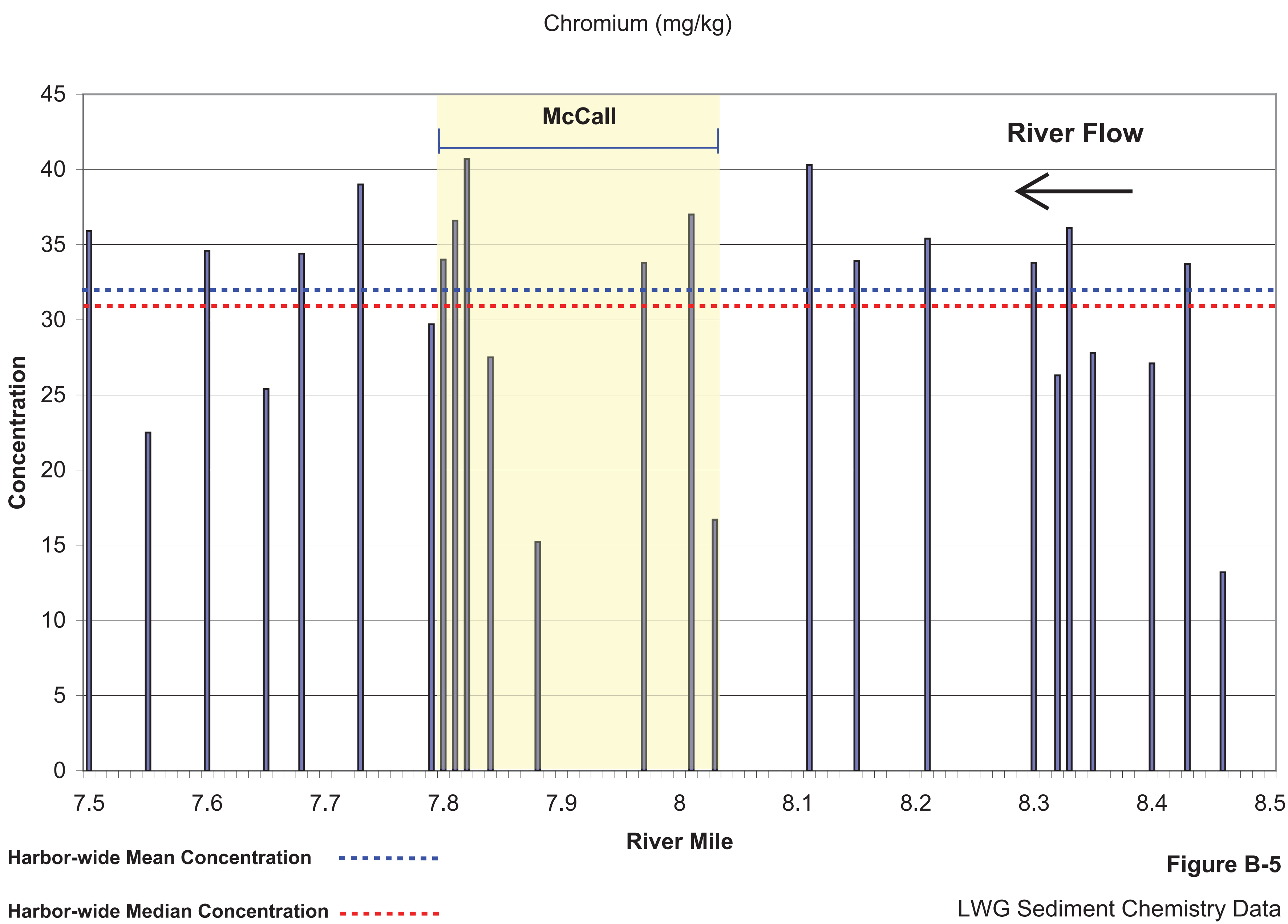


Figure B-5

LWG Sediment Chemistry Data
McCall Oil and Chemical

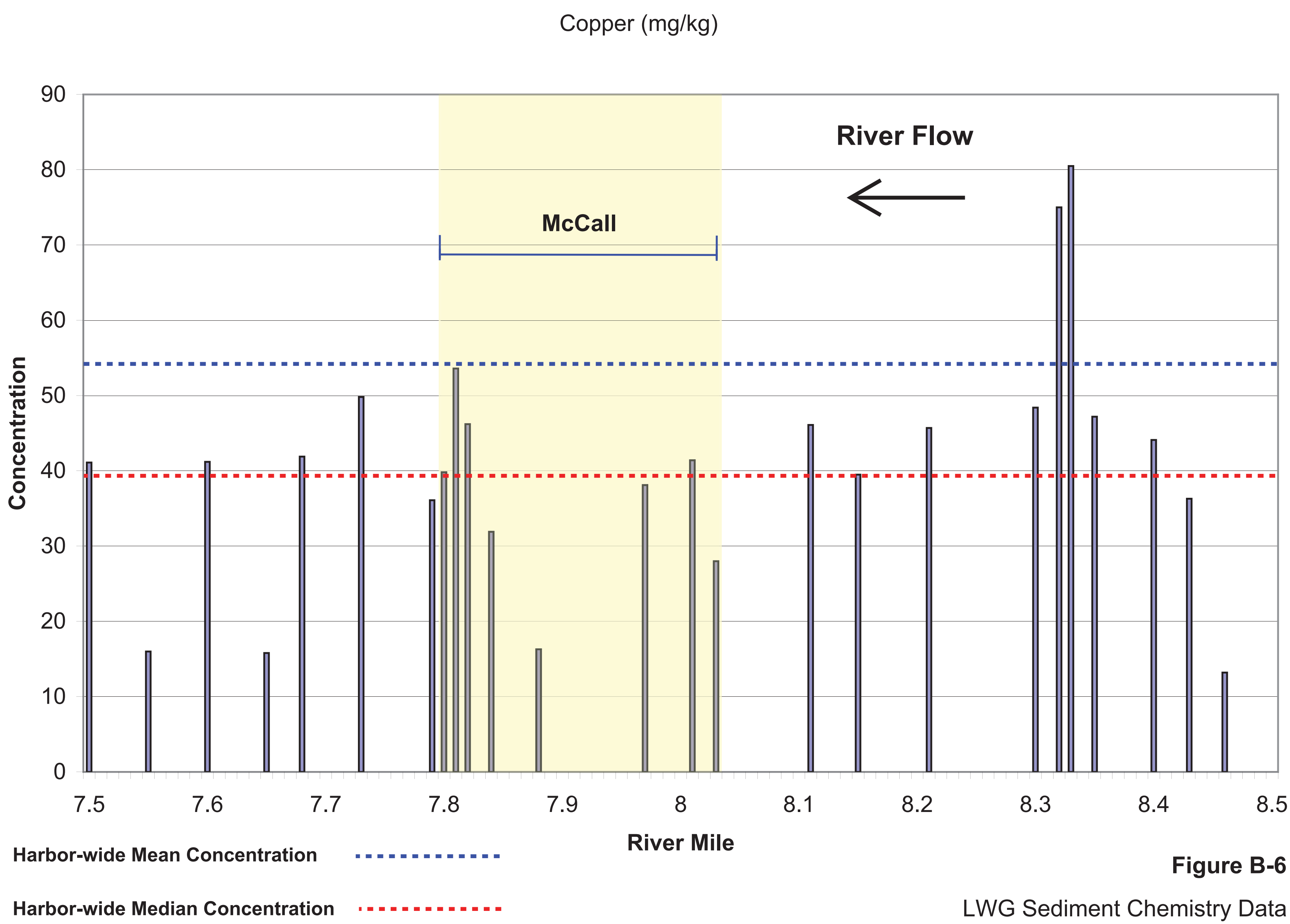


Figure B-6

LWG Sediment Chemistry Data
McCall Oil and Chemical

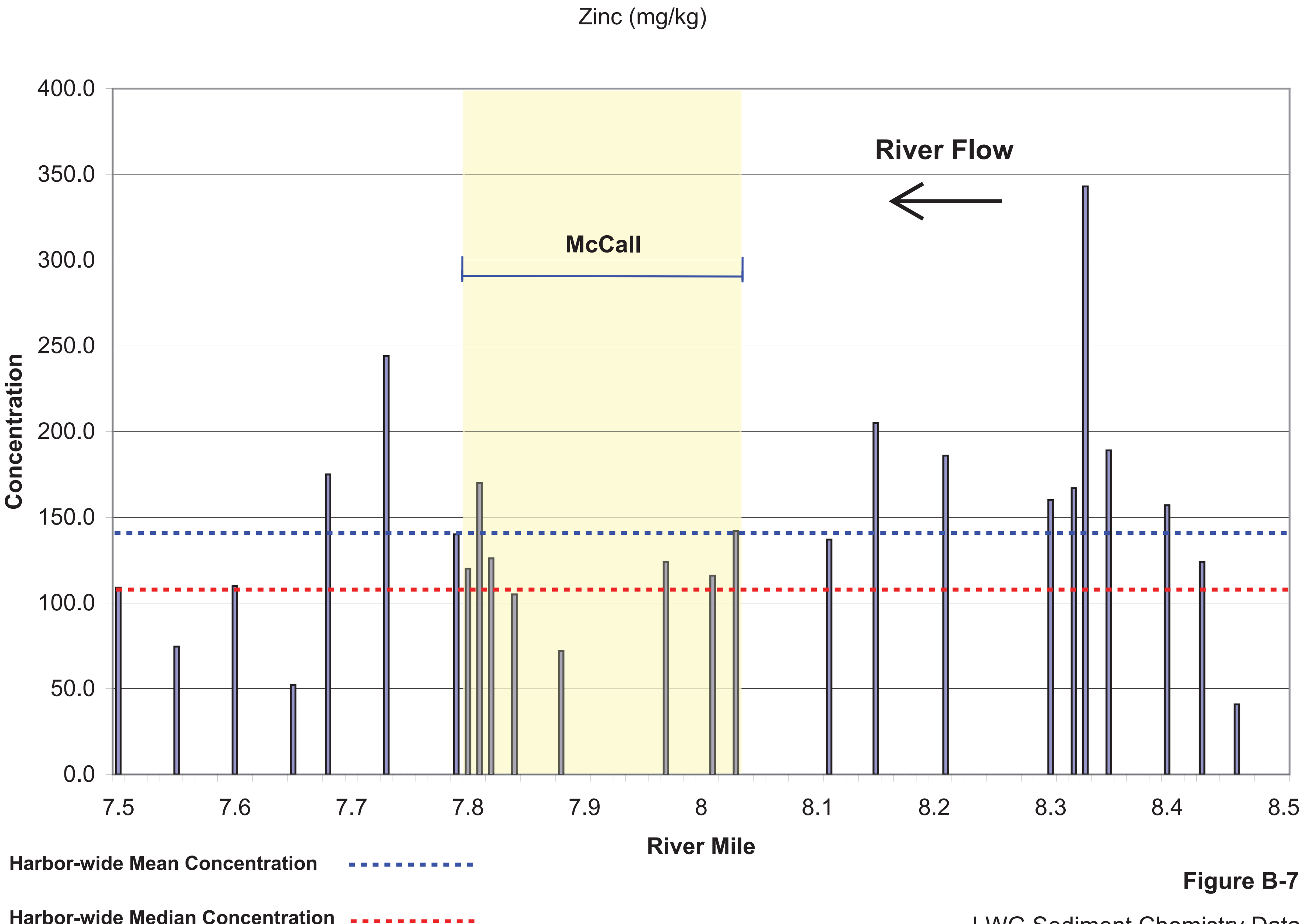


Figure B-7

LWG Sediment Chemistry Data
McCall Oil and Chemical

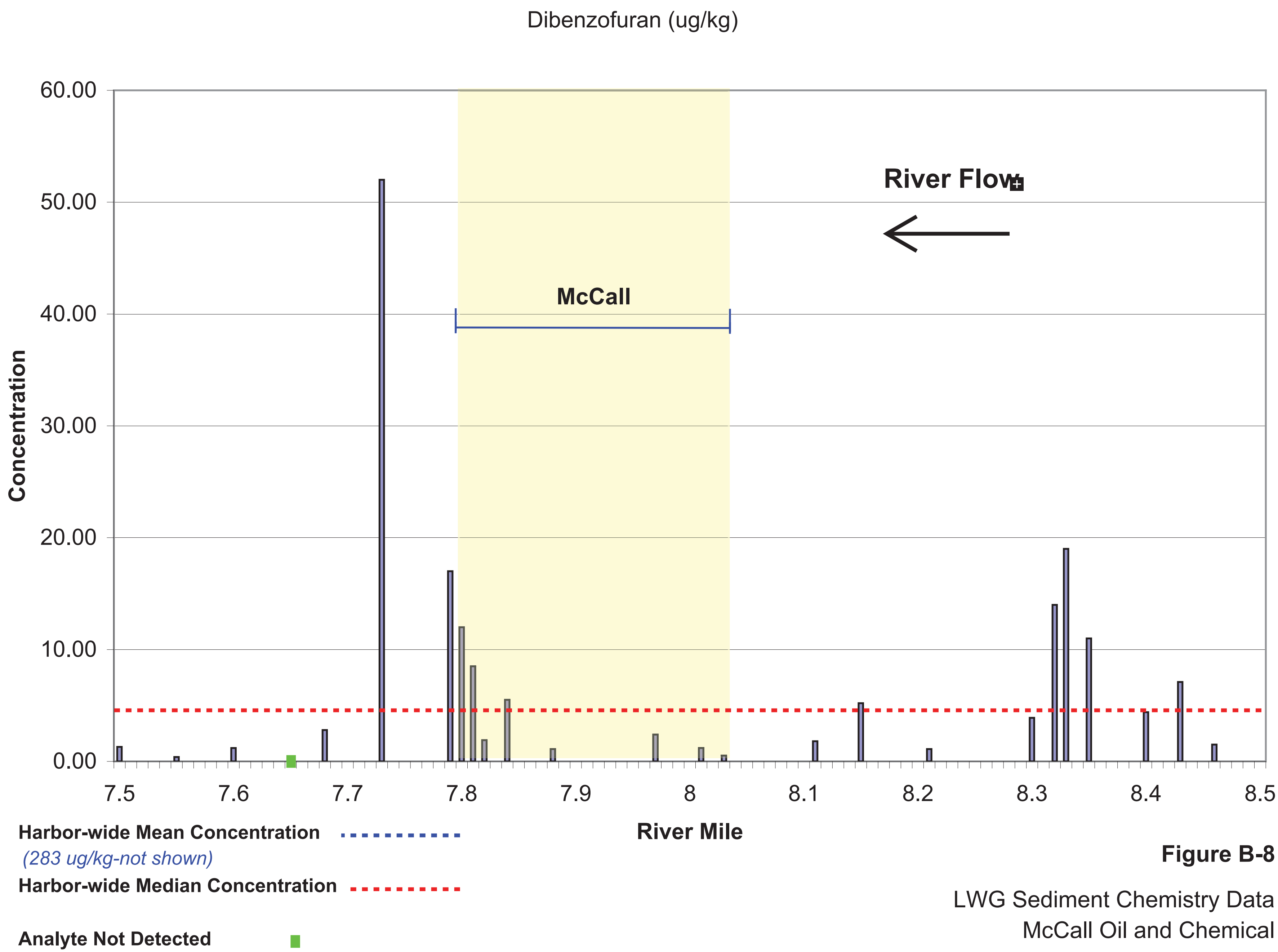


Figure B-8

LWG Sediment Chemistry Data
McCall Oil and Chemical

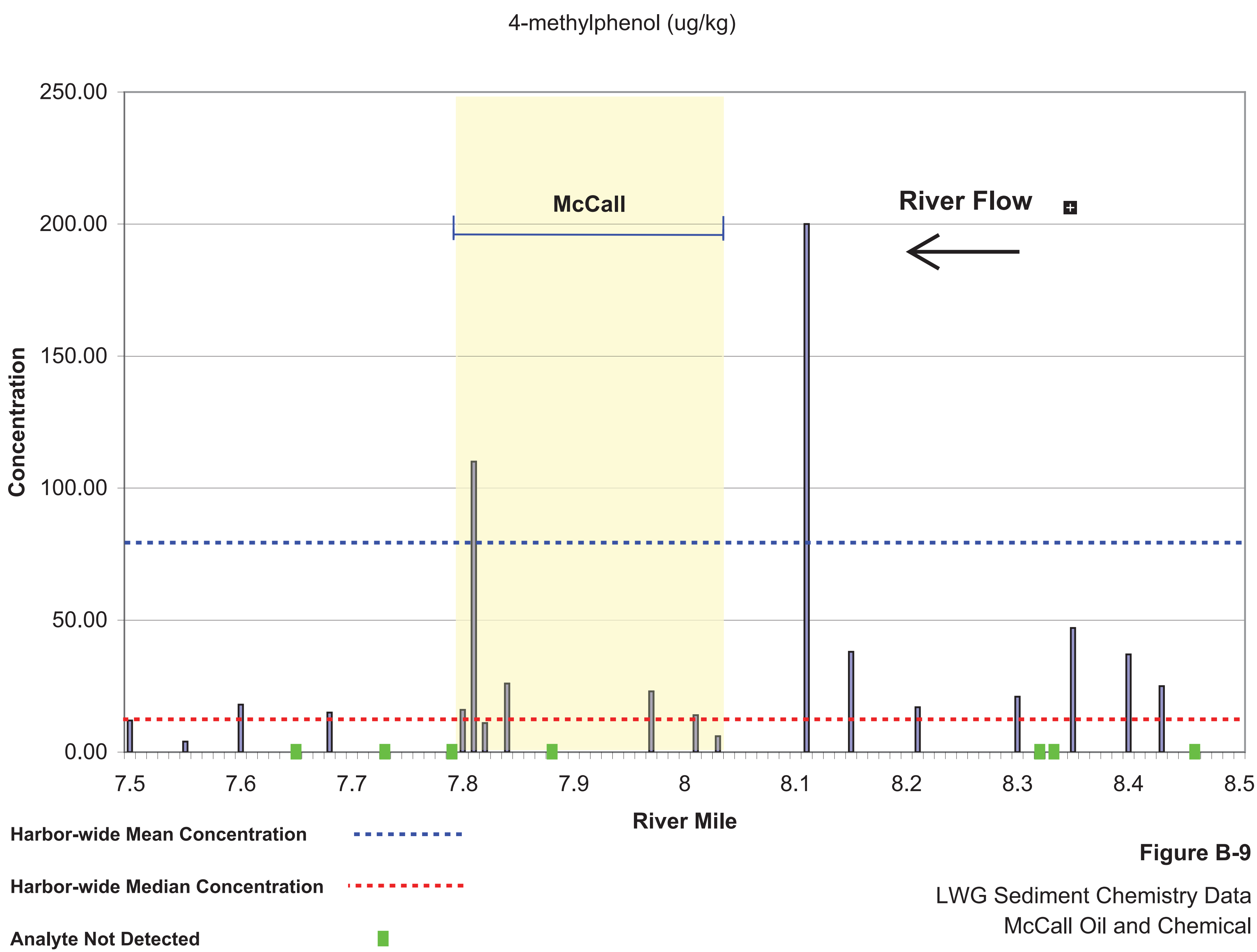
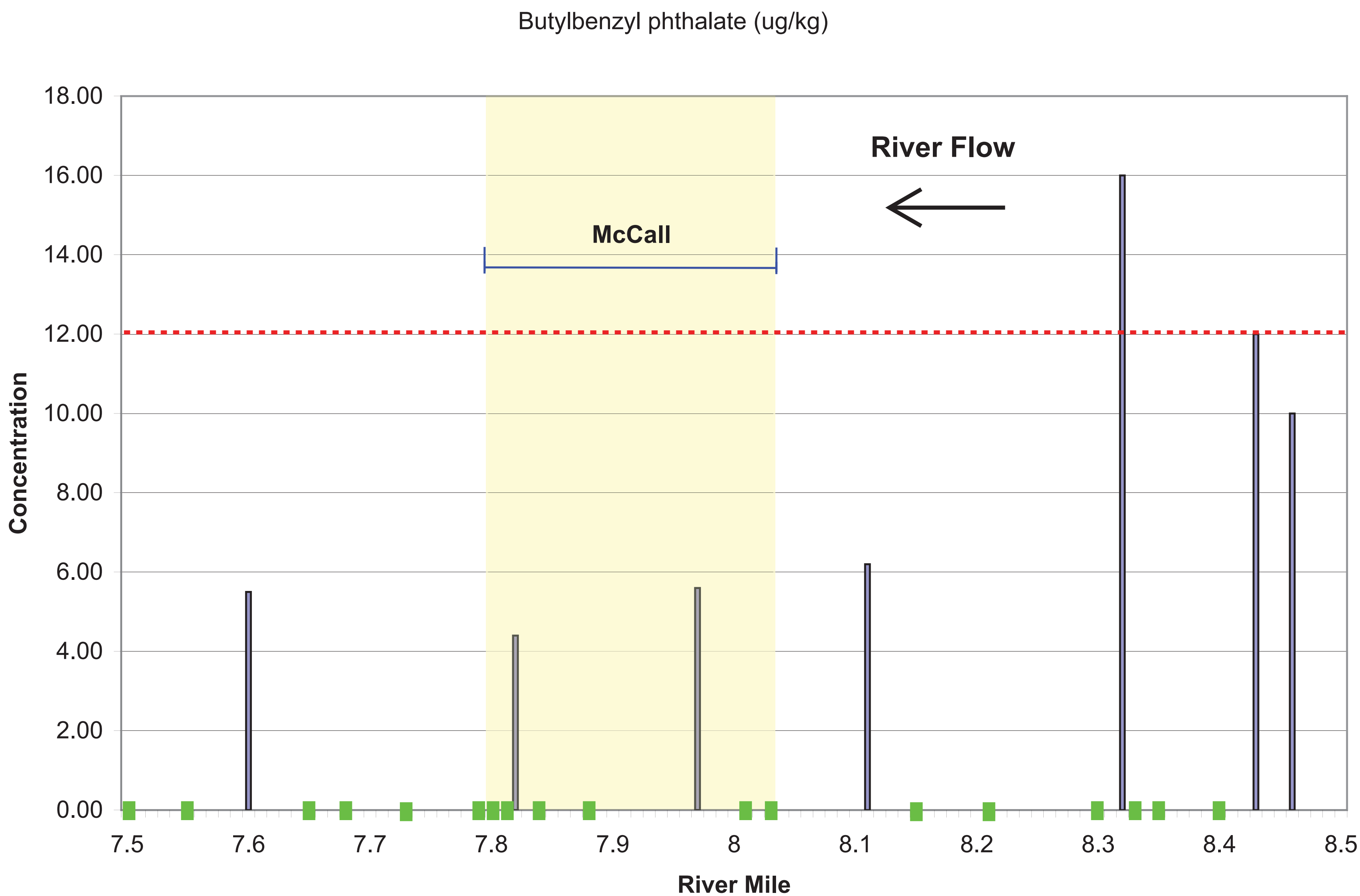


Figure B-9

LWG Sediment Chemistry Data
McCall Oil and Chemical



Harbor-wide Mean Concentration

(72.6 ug/kg-not shown)

Harbor-wide Median Concentration

Analyte Not Detected

Figure B-10

LWG Sediment Chemistry Data
McCall Oil and Chemical

Di-n-octyl phthalate (ug/kg)

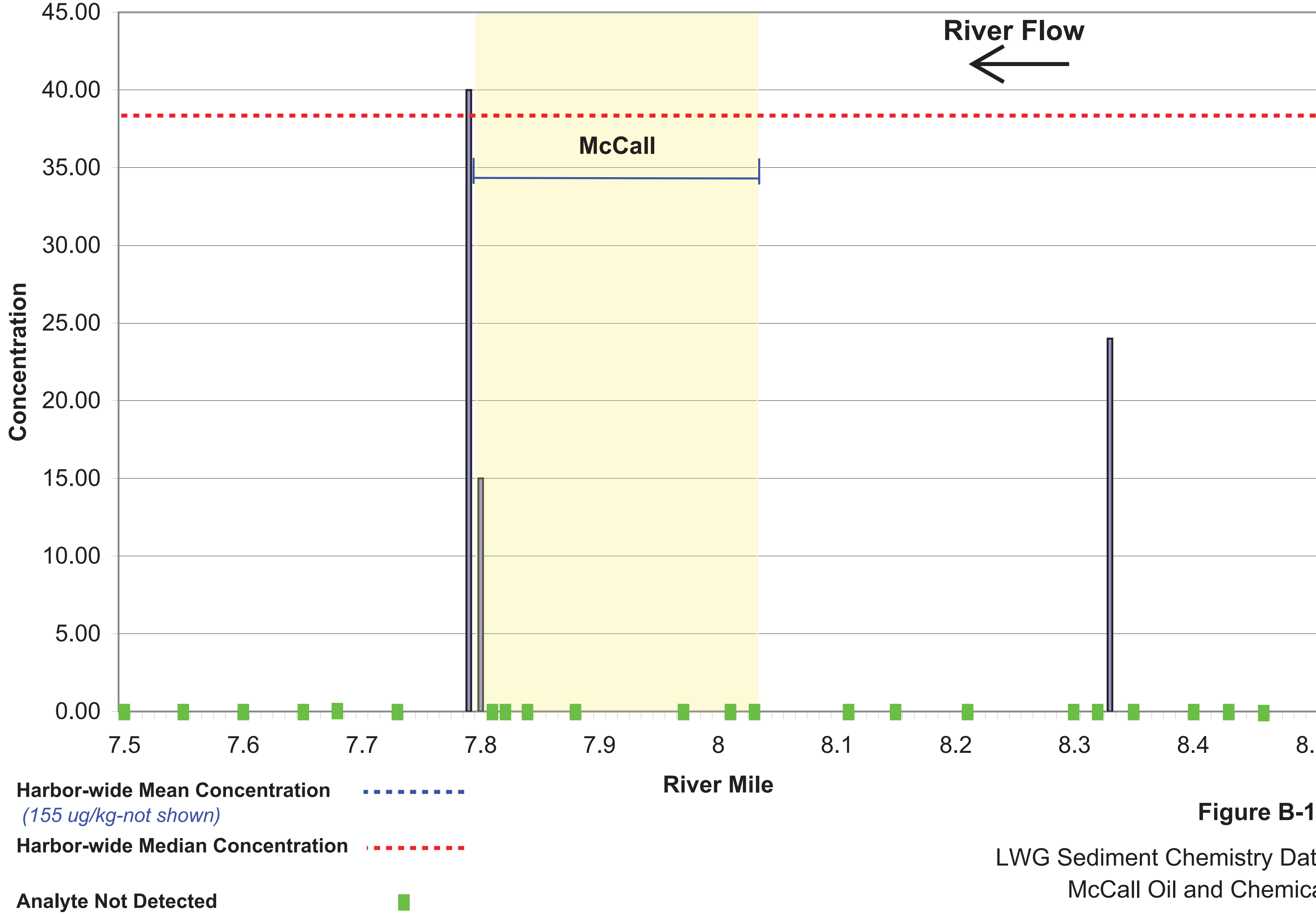


Figure B-11

LWG Sediment Chemistry Data
McCall Oil and Chemical

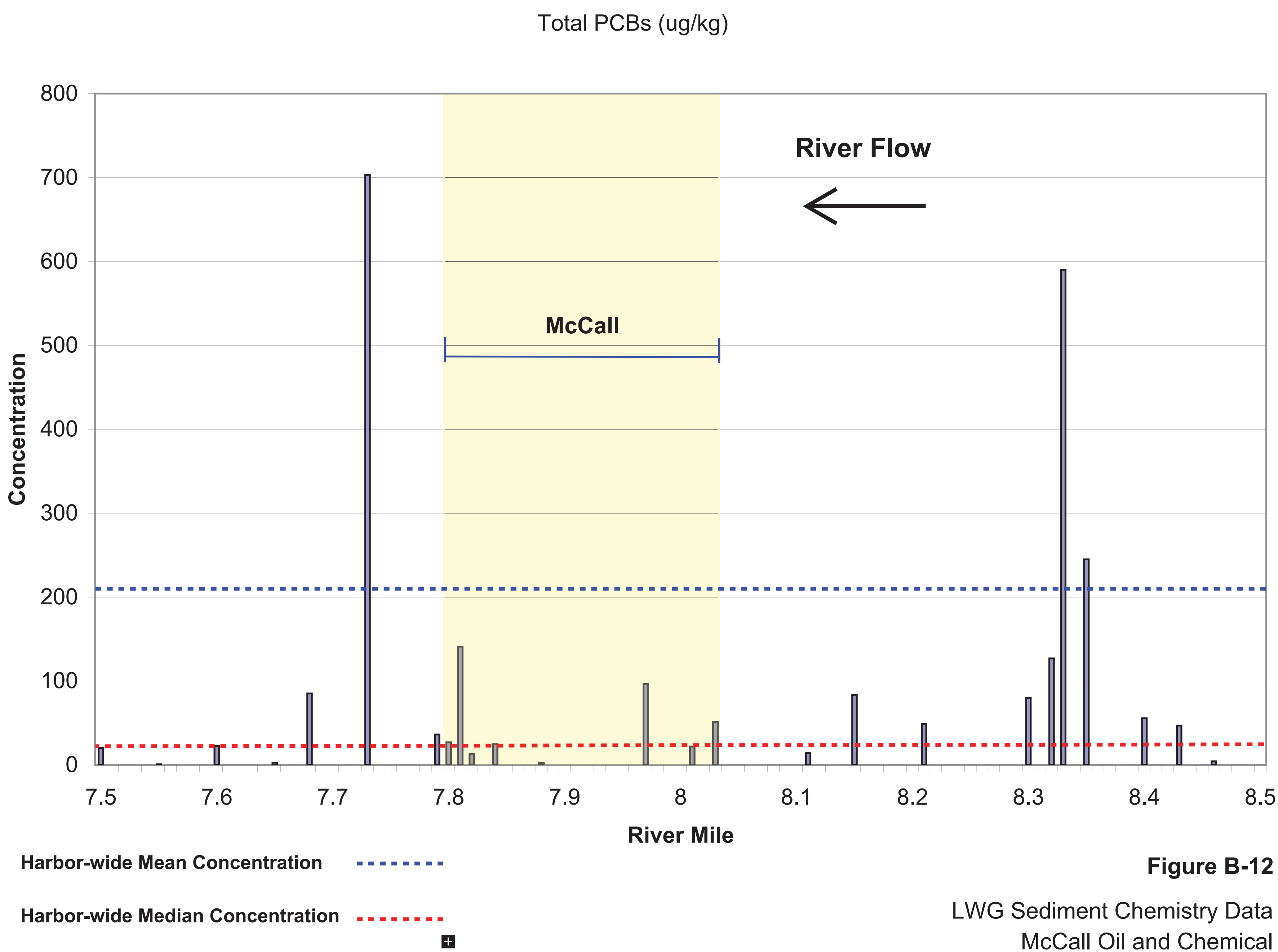
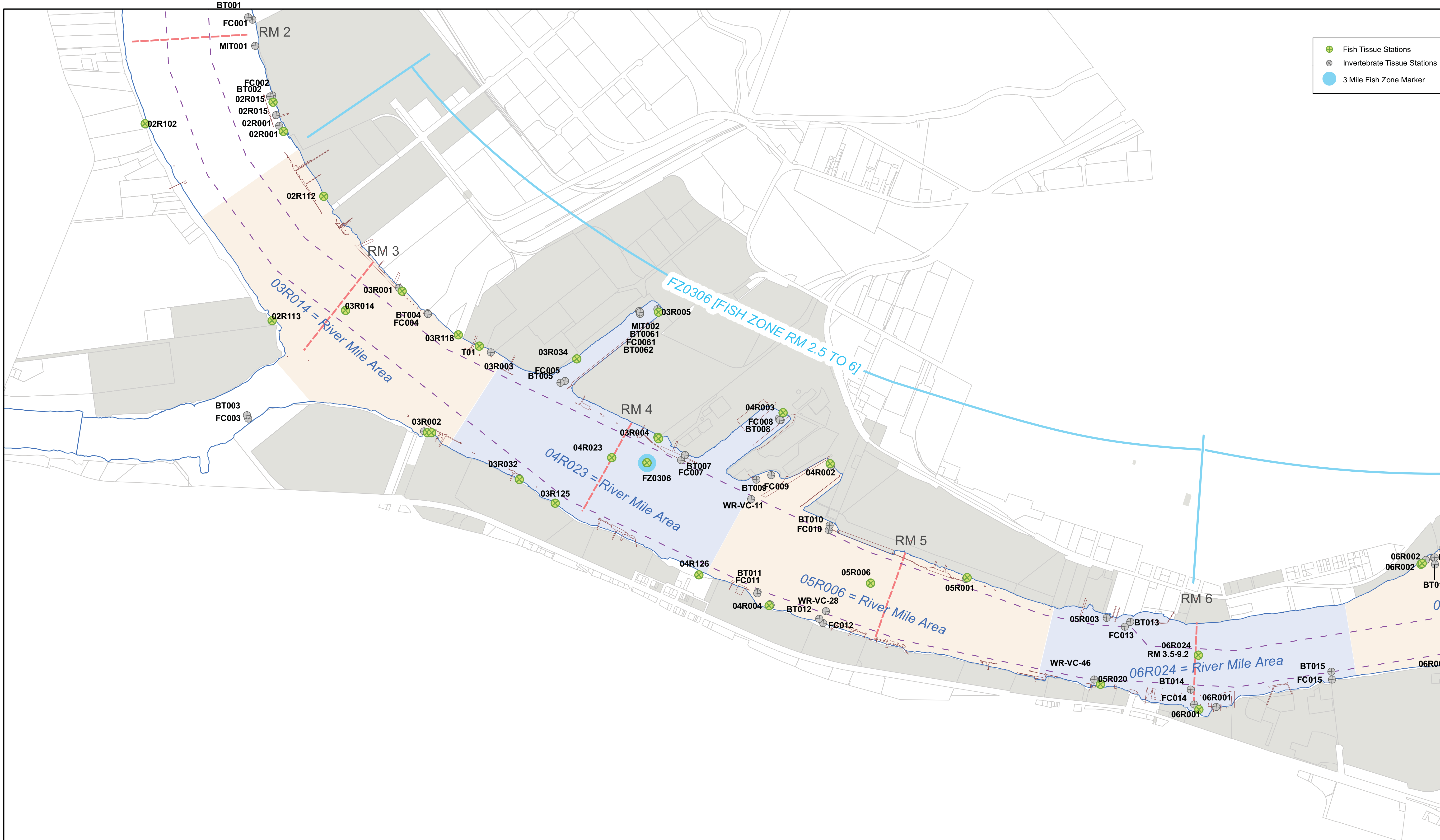


Figure B-12

LWG Sediment Chemistry Data
McCall Oil and Chemical



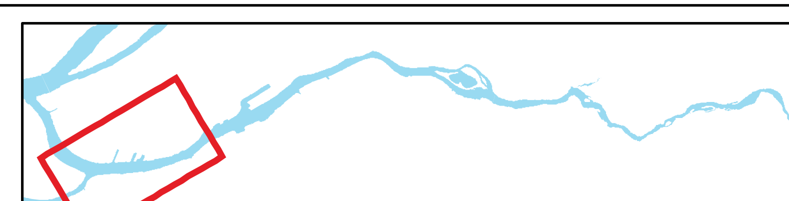
integral consulting inc.

LWG LOWER WILLAMETTE GROUP

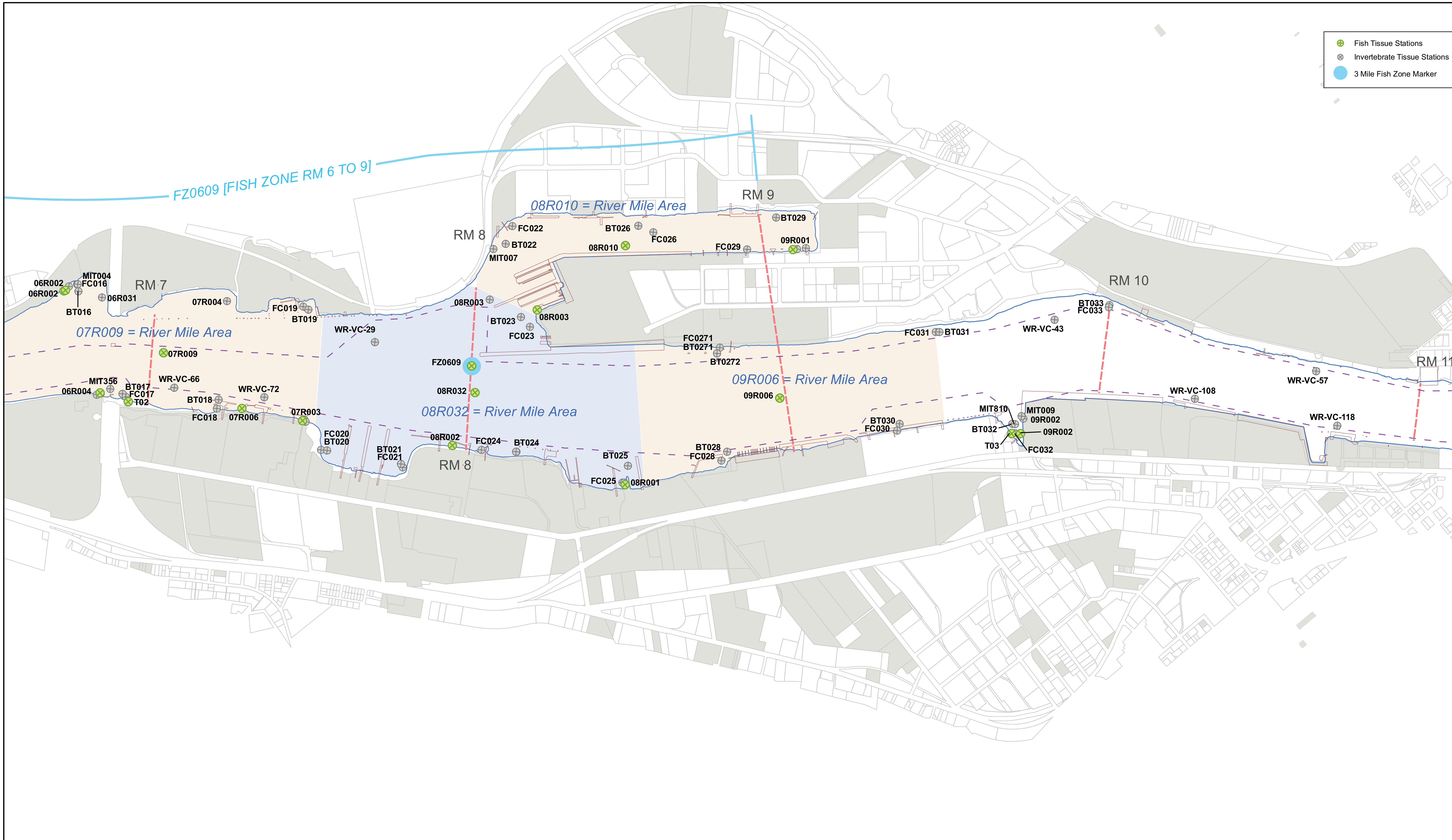
0 1,000 2,000 3,000 Feet

FEATURE SOURCES:
Transportation, Property, or Boundaries: Metro RLIS .
Channel & River miles: US Army Corps of Engineers.
Bathymetric Information: David Evans and Associates, Inc.

Navigation Channel
River Miles
Docks and Structures
Waterfront Taxlots
Upland Sites



Map 2.1-2a
Portland Harbor RI/FS
Comprehensive Round 2 Report
Fish and Invertebrate
Tissue Sampling Locations



integral consulting inc.

LWG LOWER WILLAMETTE GROUP

0 1,000 2,000 3,000 Feet

FEATURE SOURCES:
Transportation, Property, or Boundaries: Metro RLIS .
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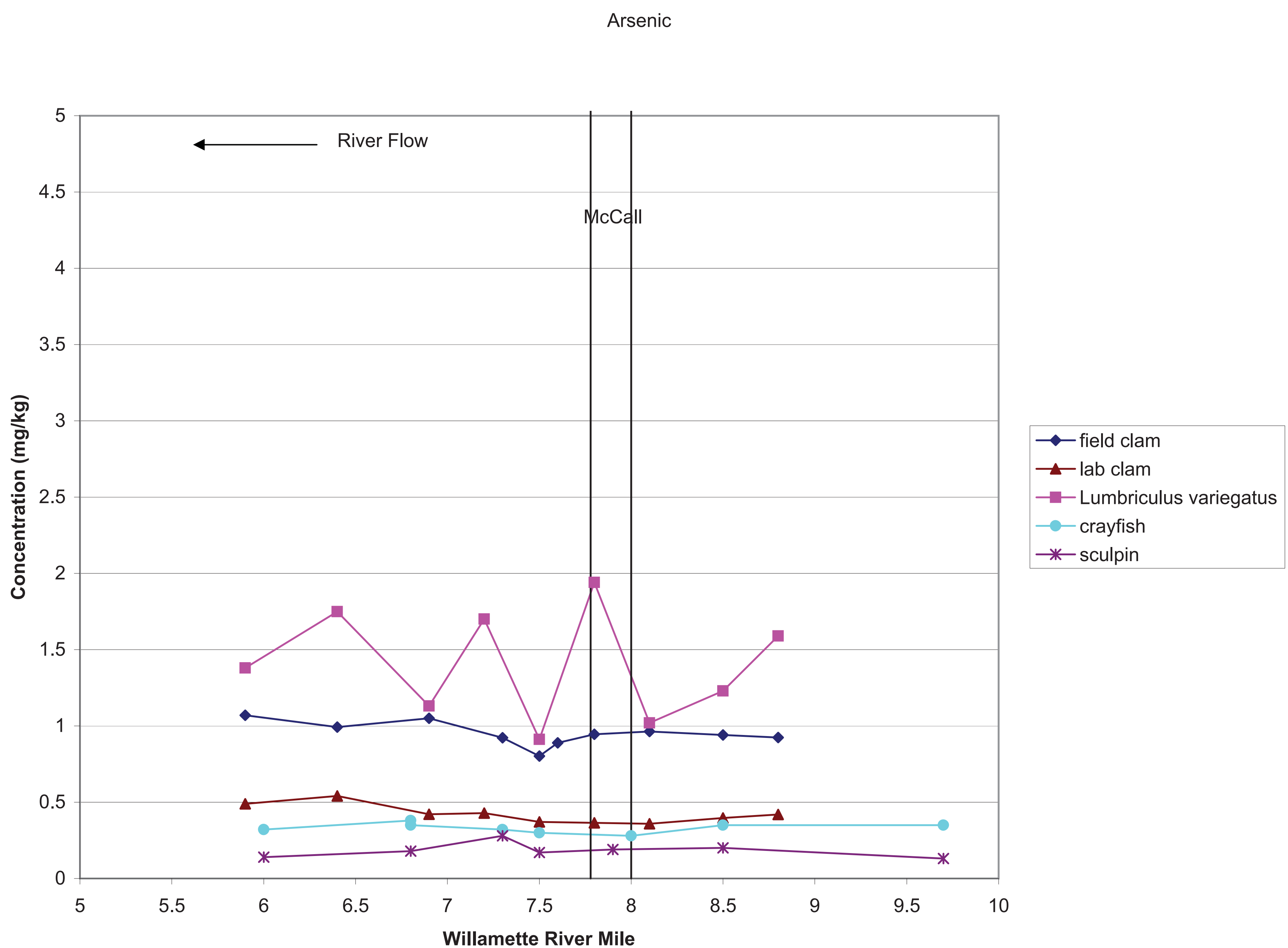
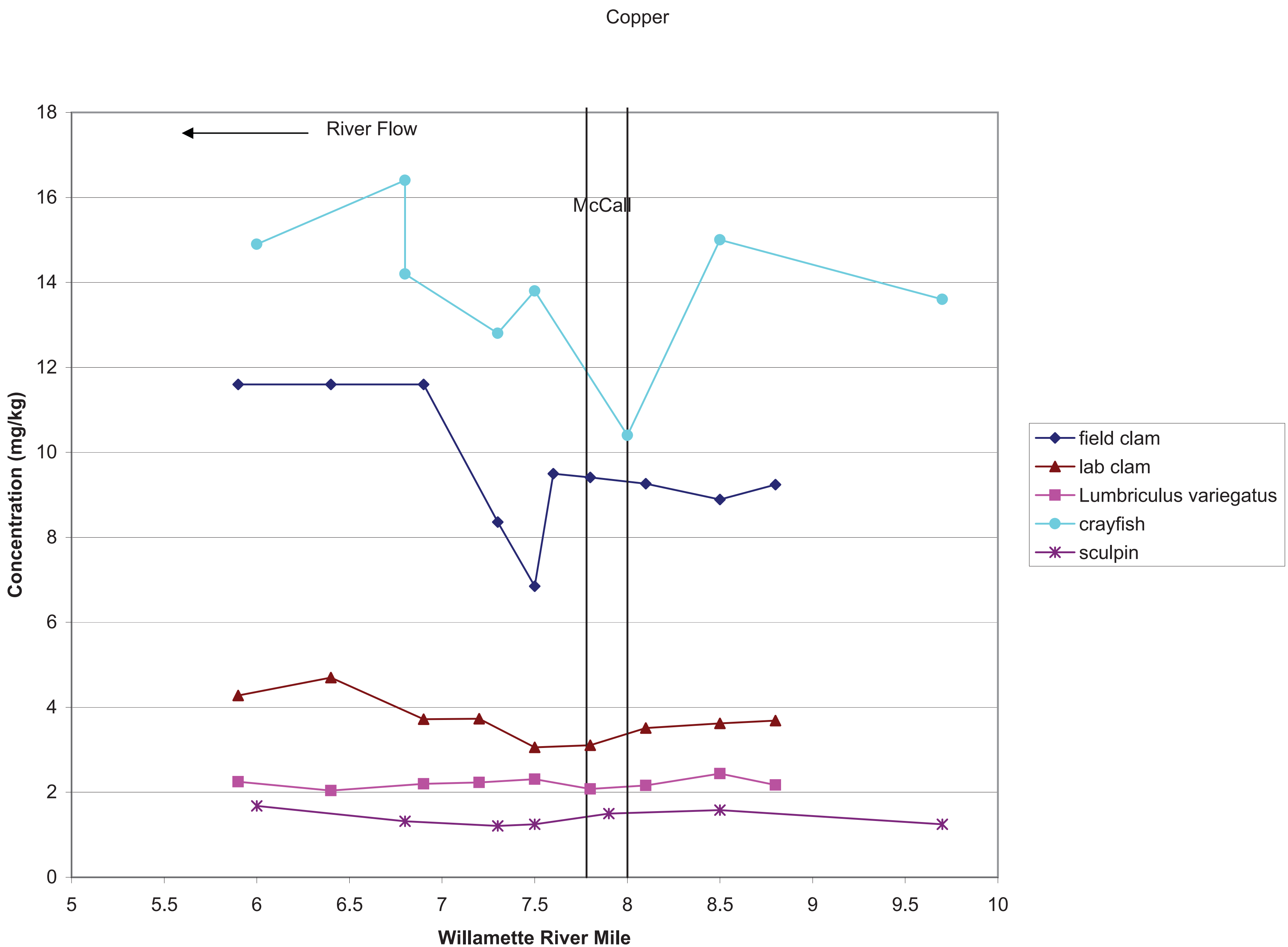
Bathymetric Information: David Evans and Associates, Inc.

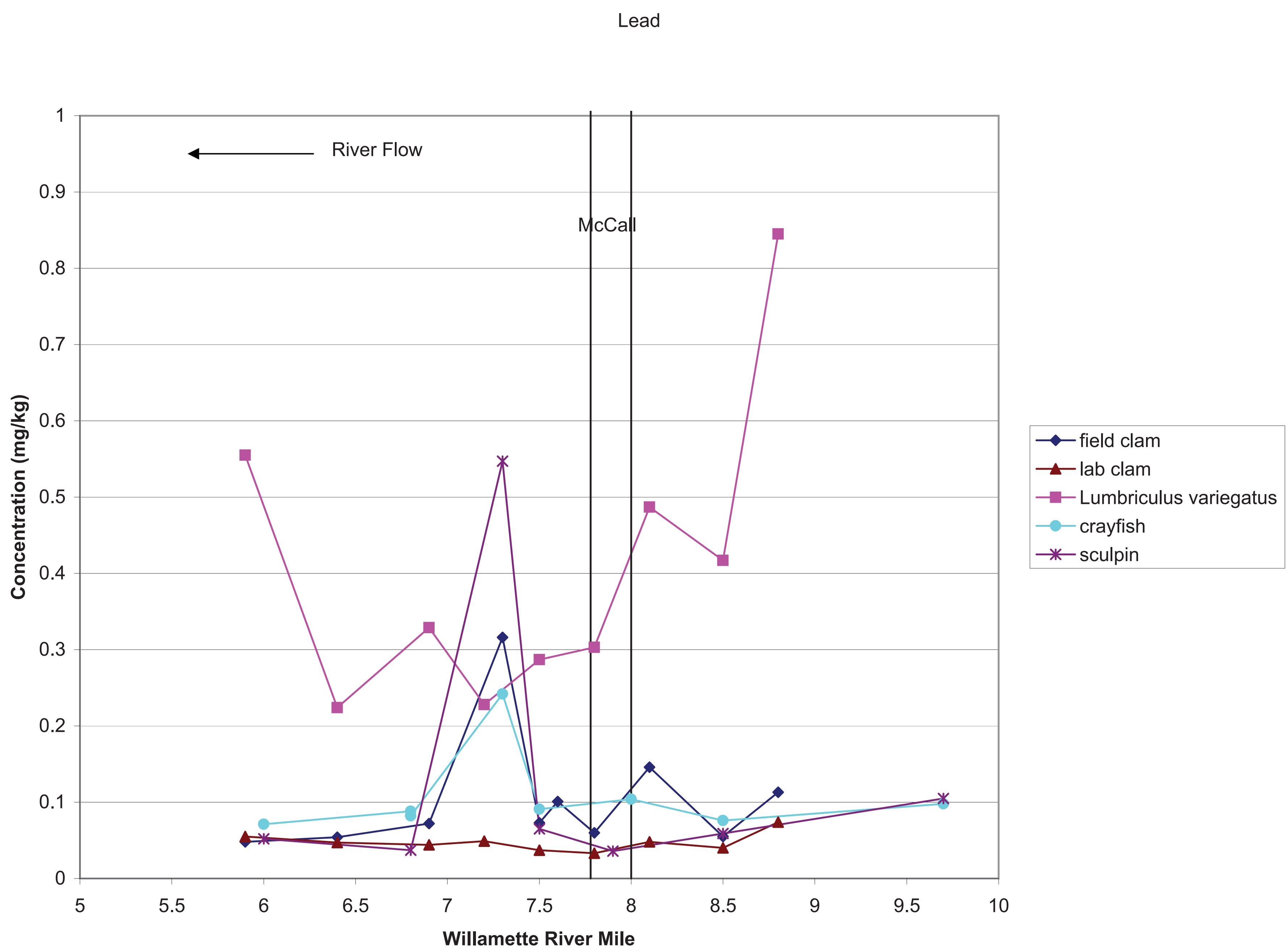
Navigation Channel
River Miles
Docks and Structures
Waterfront Taxlots
Upland Sites

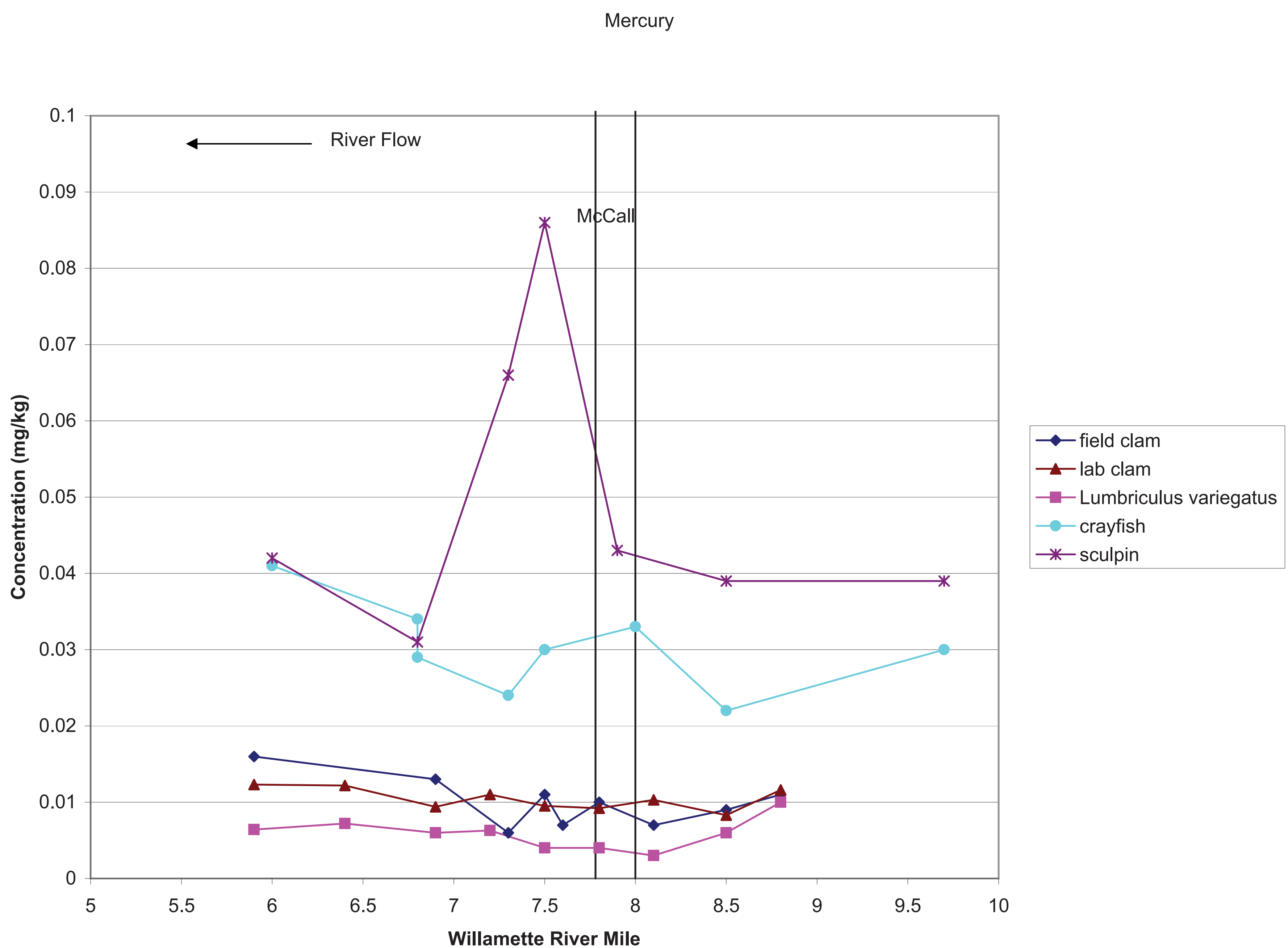
Map 2.1-2b
Portland Harbor RI/FS
Comprehensive Round 2 Report
Fish and Invertebrate
Tissue Sampling Locations



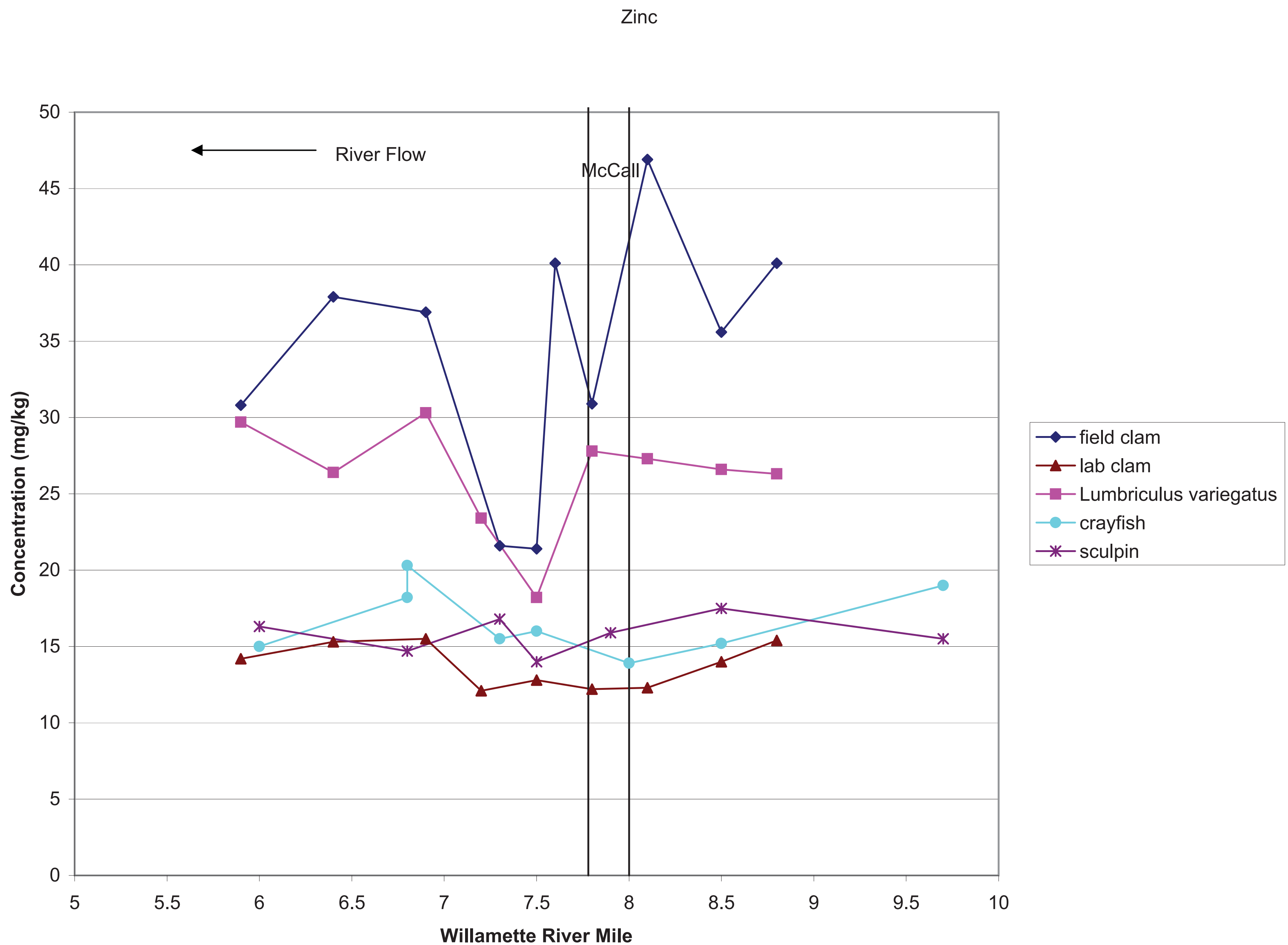
Arsenic
River Flow
McCall
Concentration (mg/kg)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin


Copper
River Flow
McCall
Concentration (mg/kg)
Willamette River Mile
18
16
14
12
10
8
6
4
2
0
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

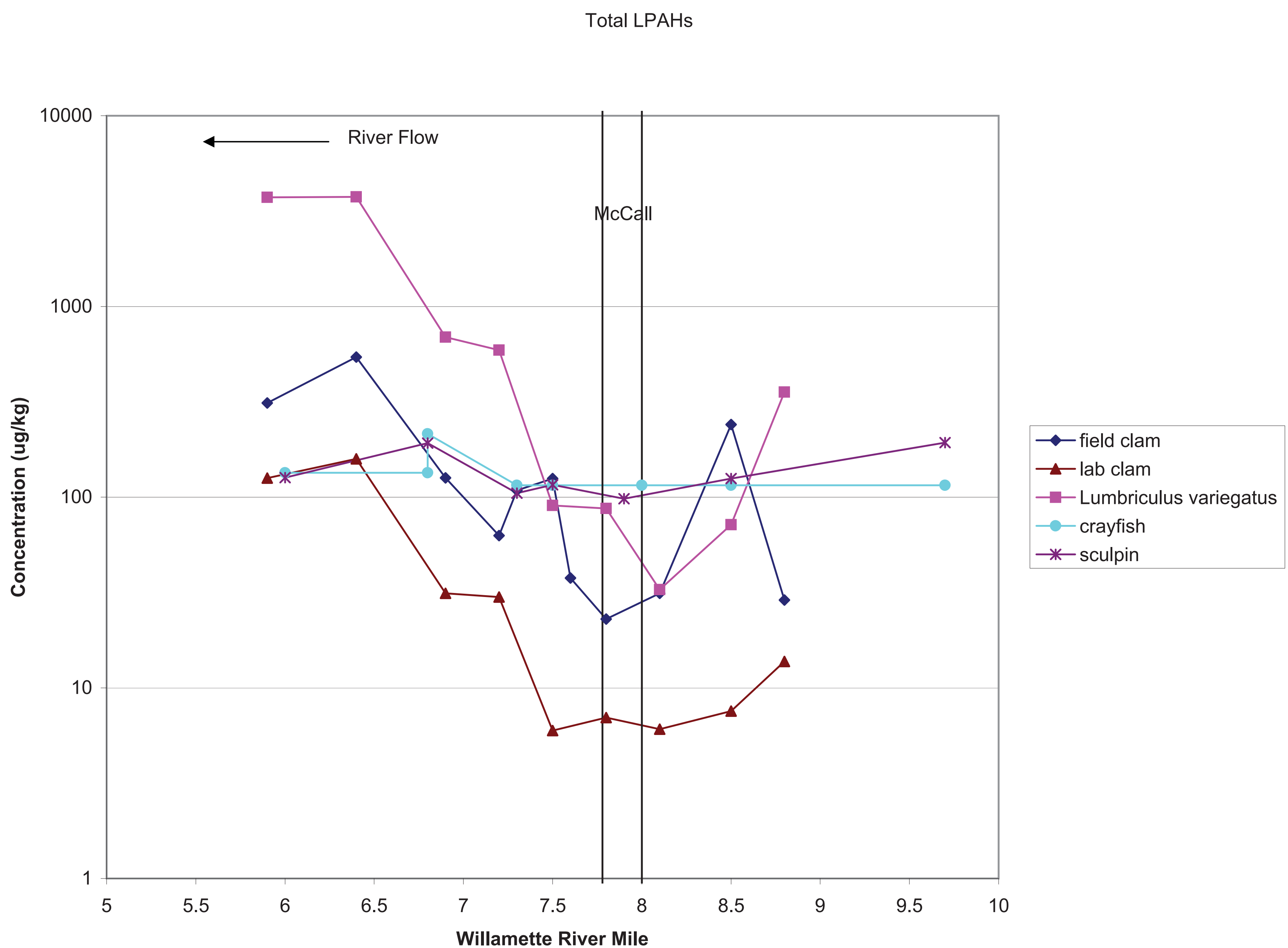

Lead
River Flow
McCall
Concentration (mg/kg)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

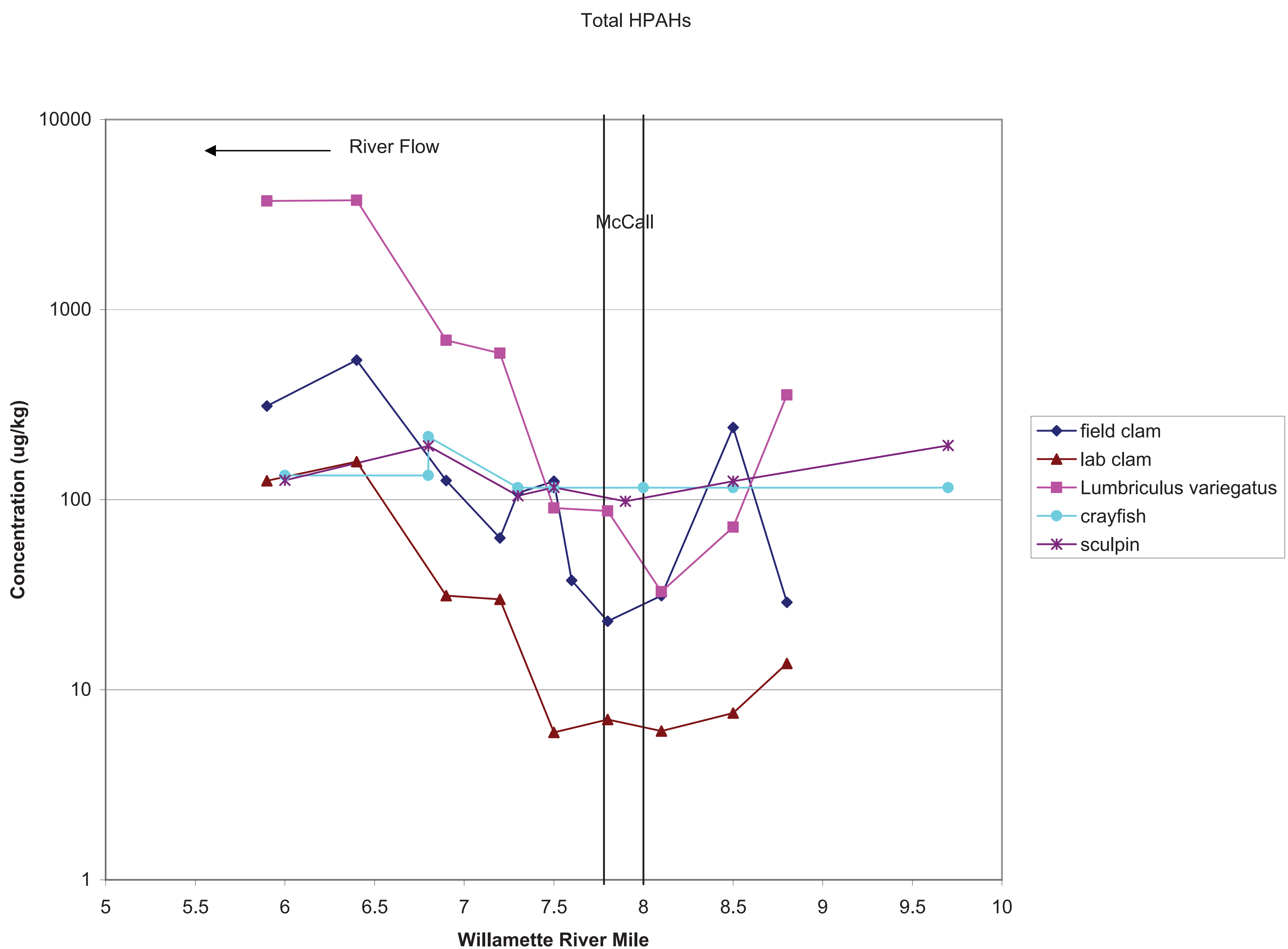


Mercury
River Flow
McCall
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Concentration (mg/kg)
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

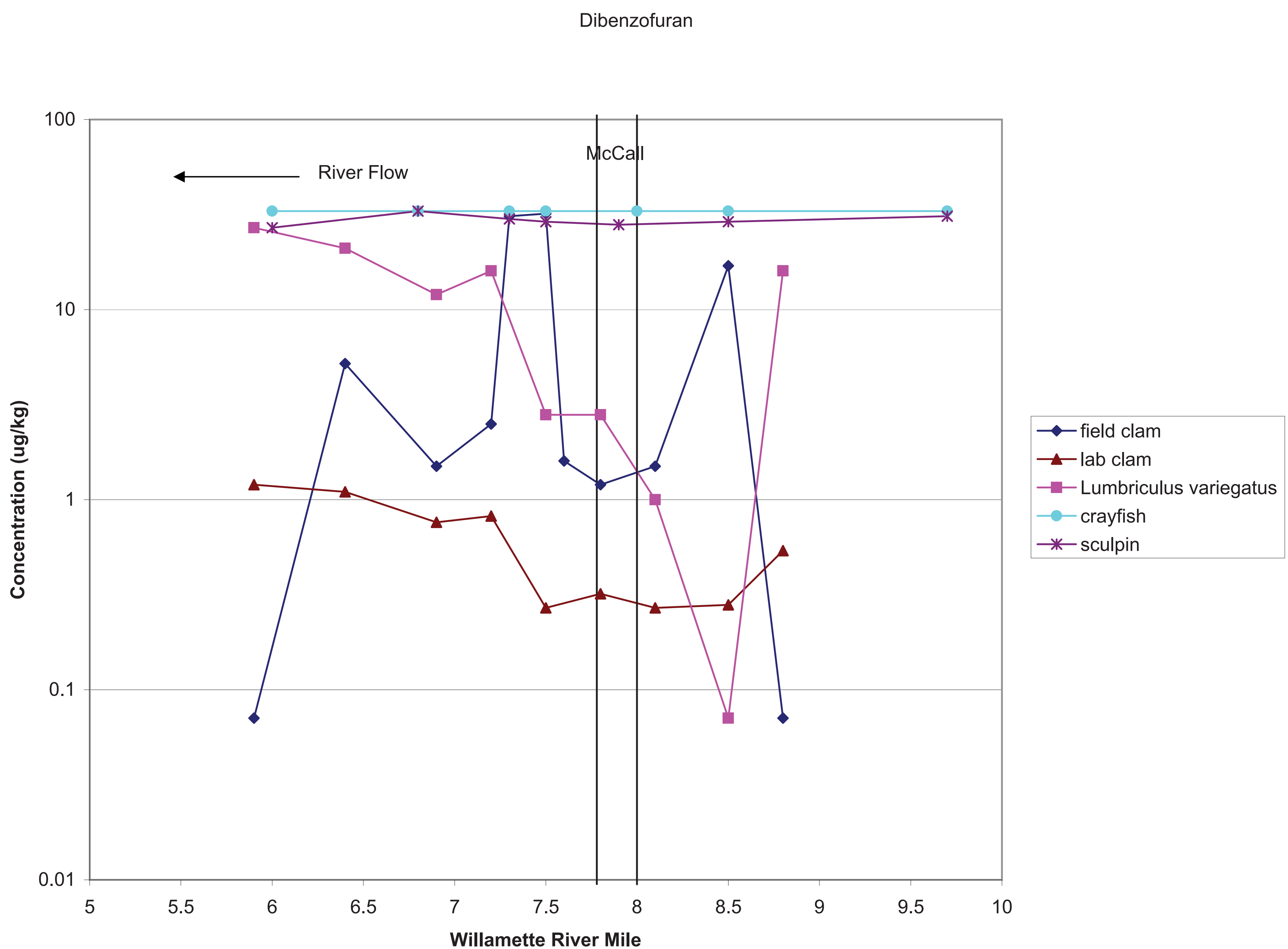


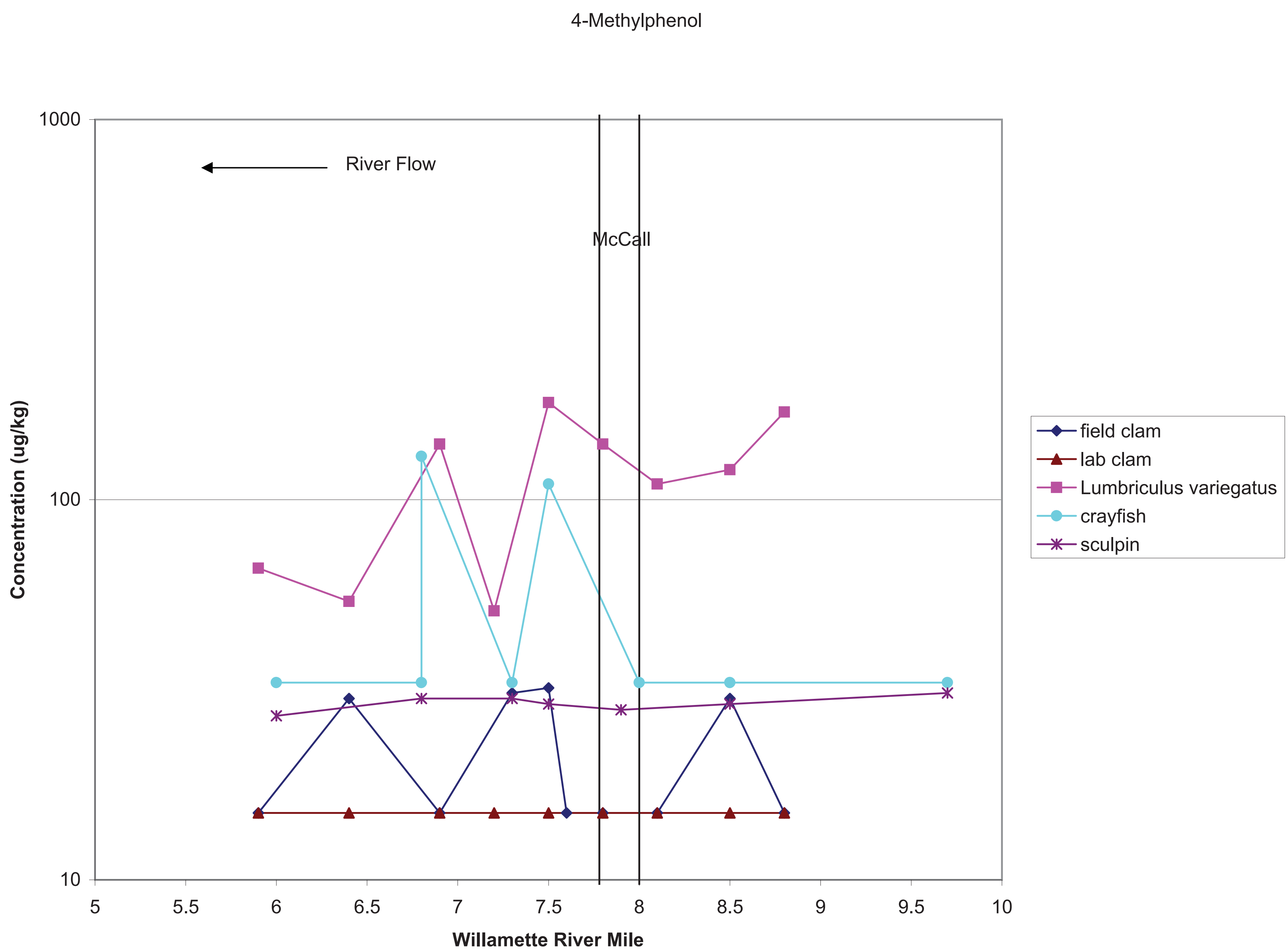
Zinc
River Flow
McCall
Concentration (mg/kg)
Willamette River Mile
0
5
10
15
20
25
30
35
40
45
50
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin


Total LPAHs
River Flow
McCall
Concentration (ug/kg)
10000
1000
100
10
1
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

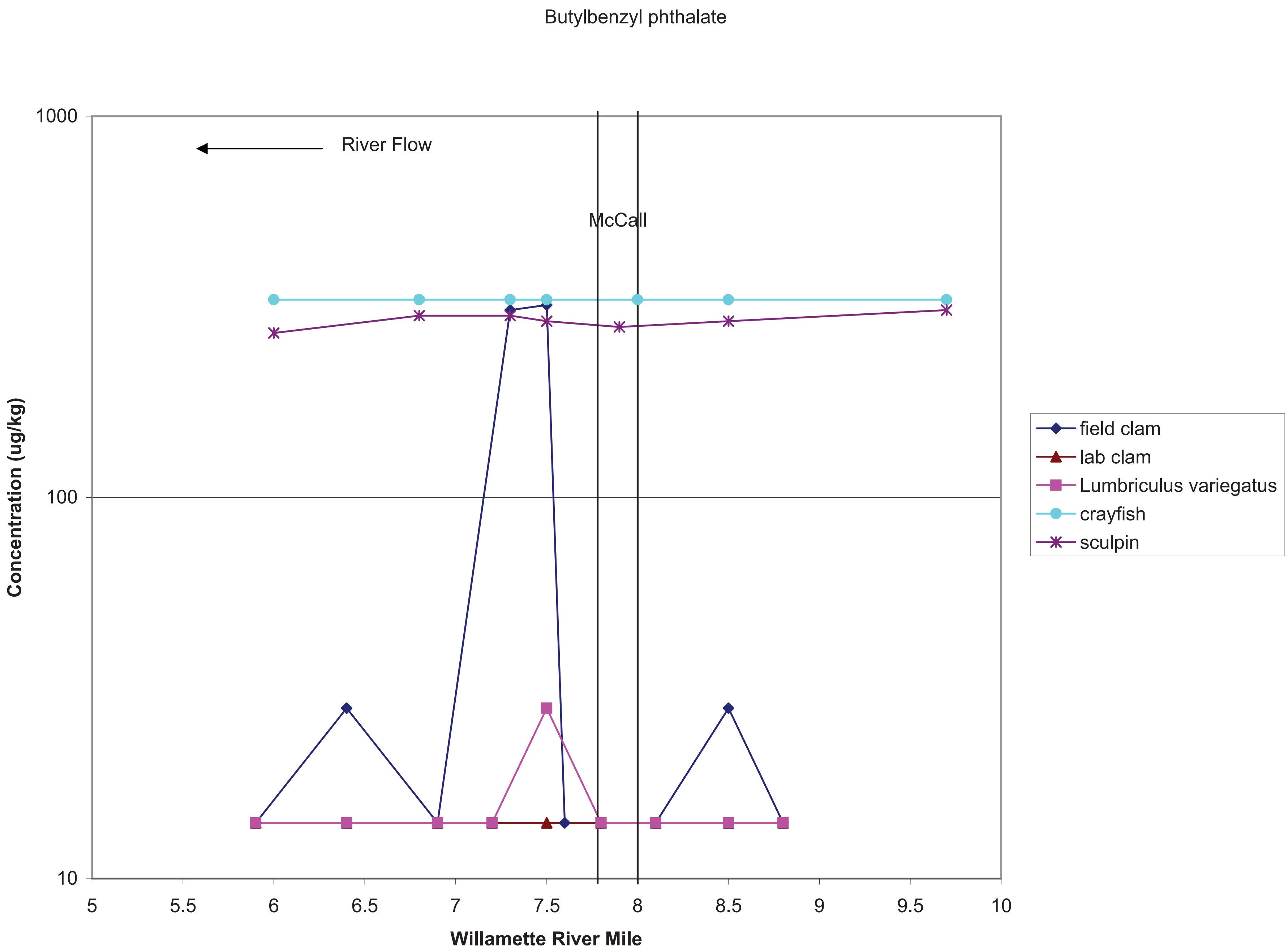


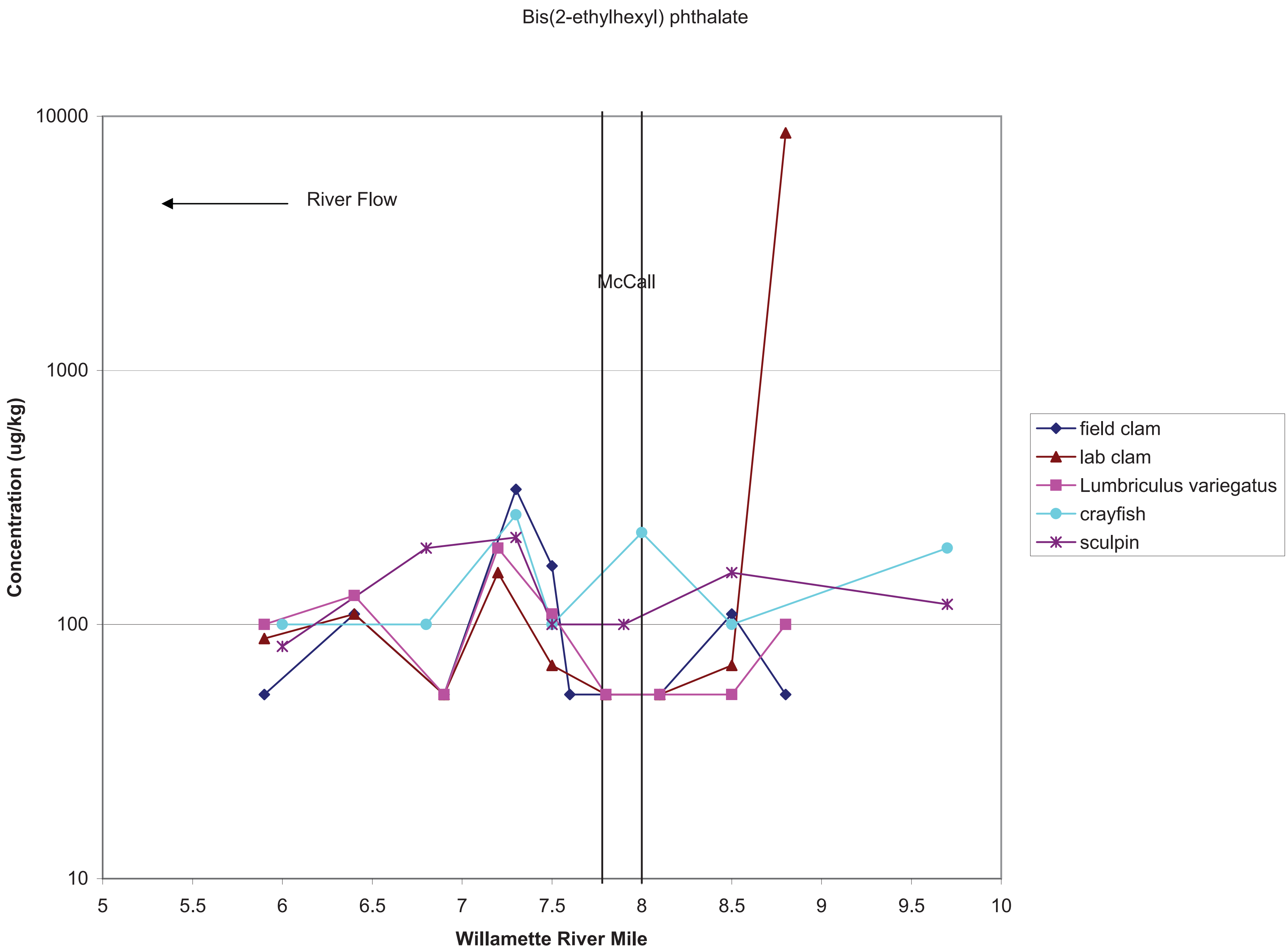
Total HPAHs
River Flow
McCall
Concentration (ug/kg)
10000
1000
100
10
1
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin


Dibenzofuran
Concentration (ug/kg)
100
10
1
0.1
0.01
McCall
River Flow
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

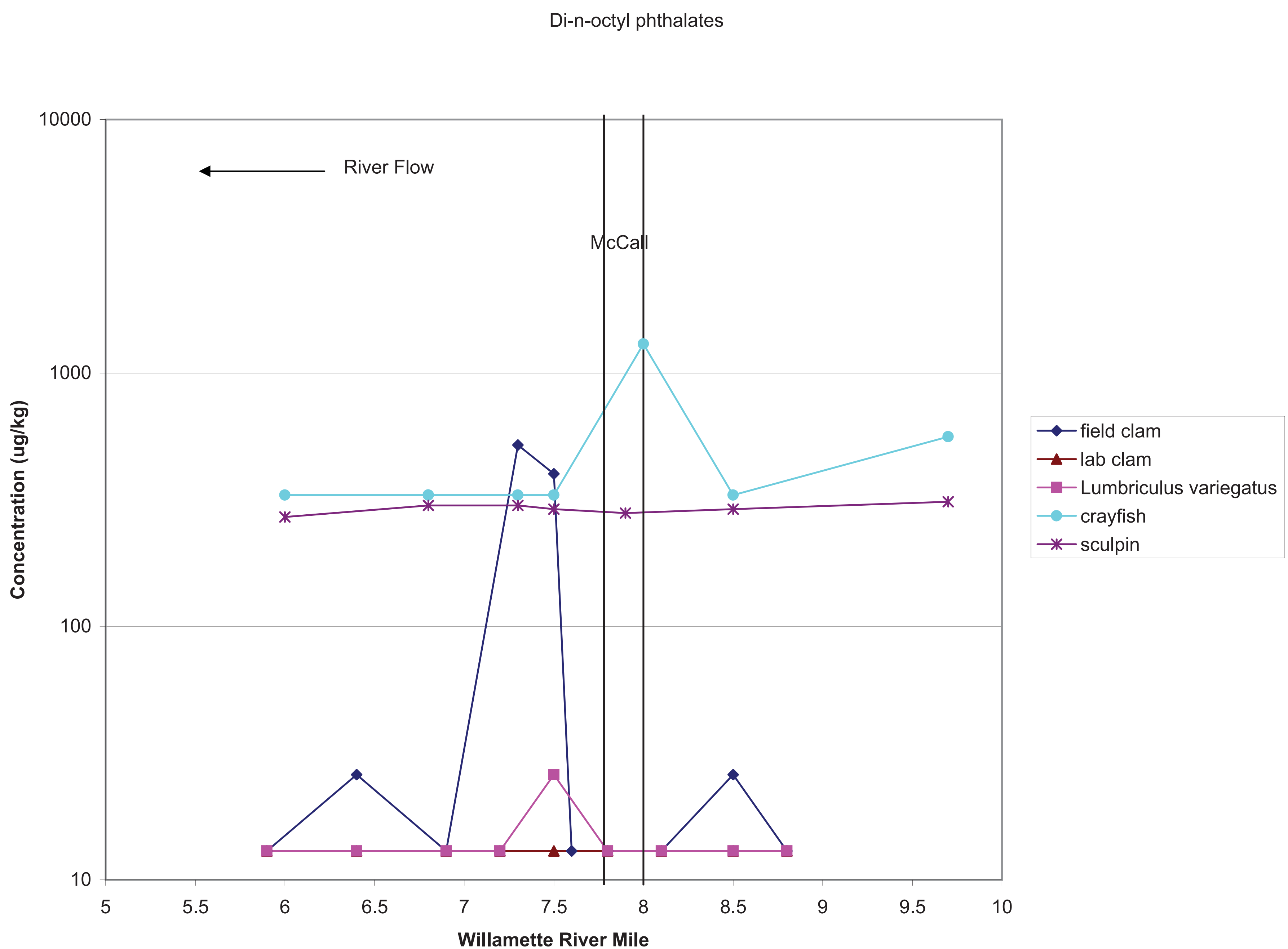


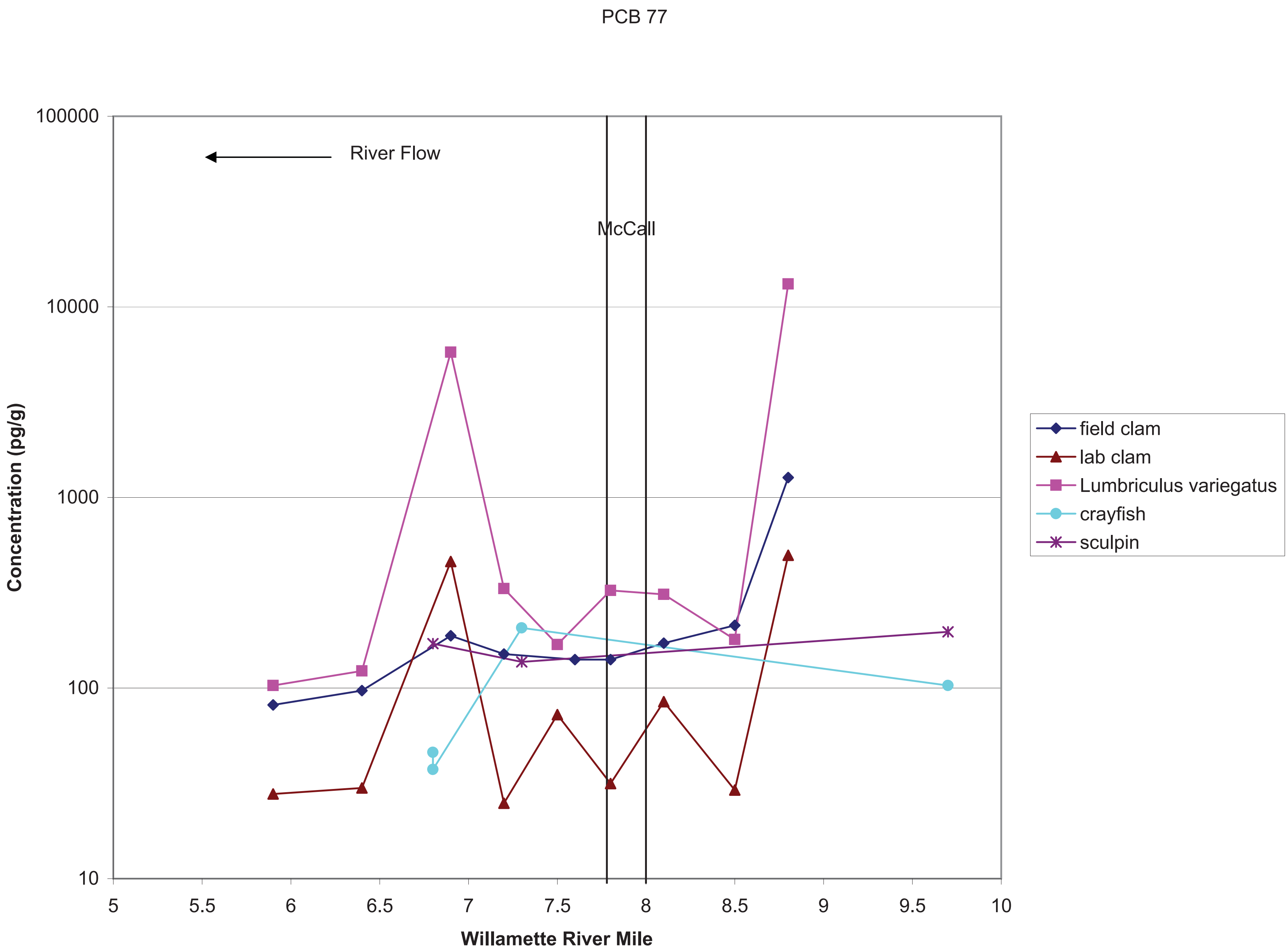
4-Methylphenol
River Flow
McCall
Concentration (ug/kg)
1000
100
10
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin


Butylbenzyl phthalate
River Flow
McCall
Concentration (ug/kg)
1000
100
10
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

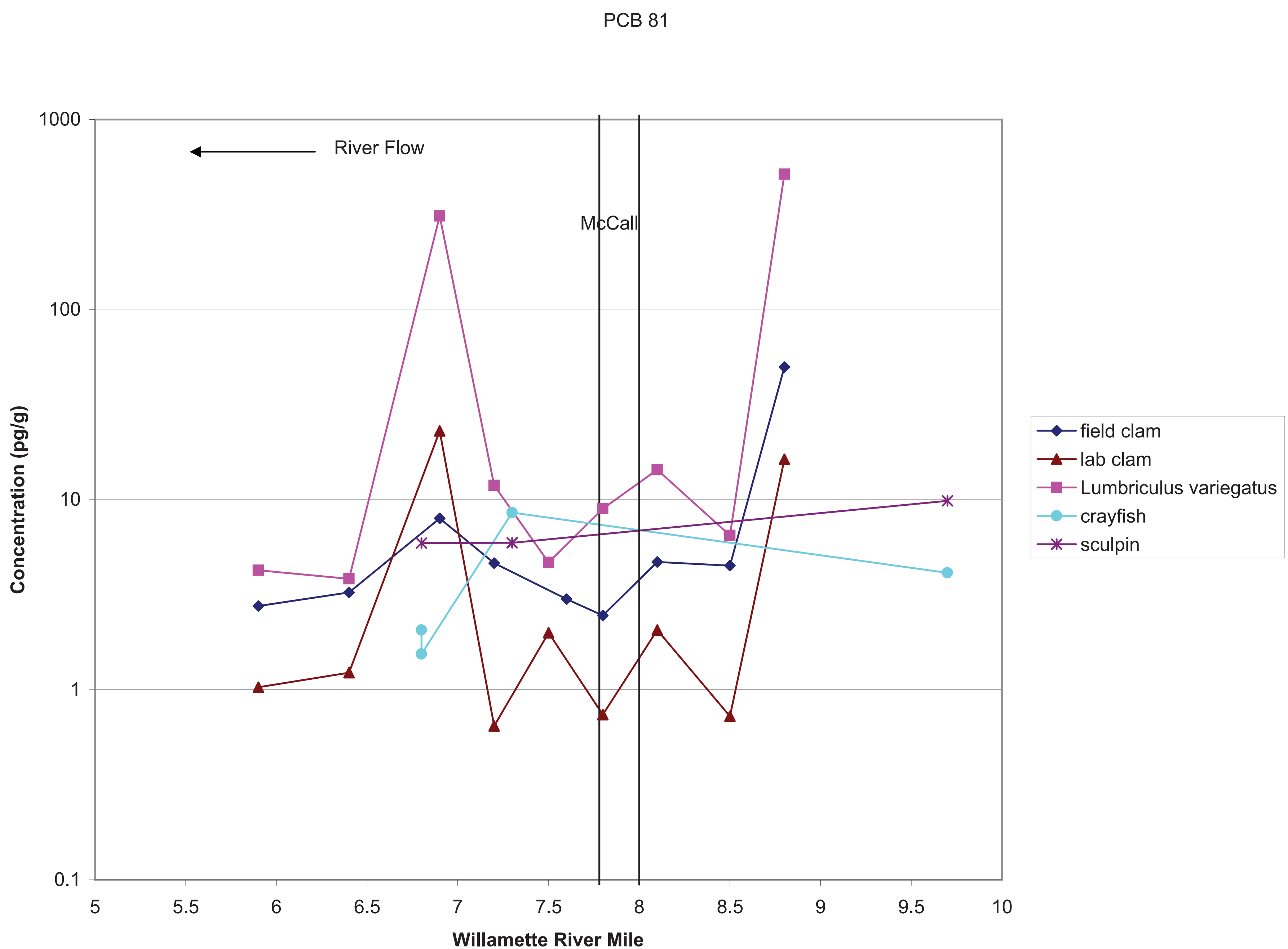


Bis(2-ethylhexyl) phthalate
River Flow
McCall
Concentration (ug/kg)
10000
1000
100
10
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

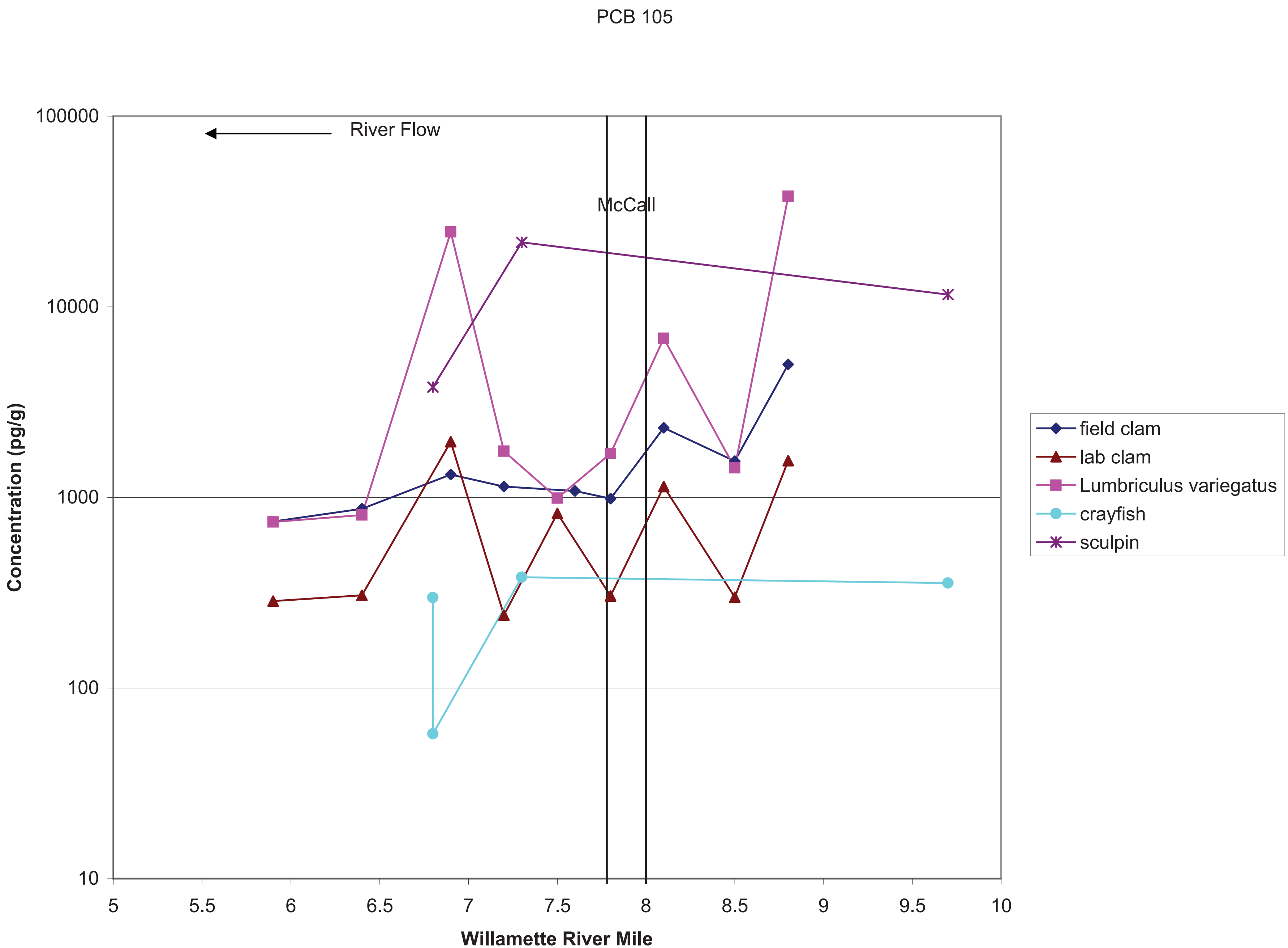

Di-n-octyl phthalates
10000
1000
100
10
River Flow
McCall
Concentration (ug/kg)
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

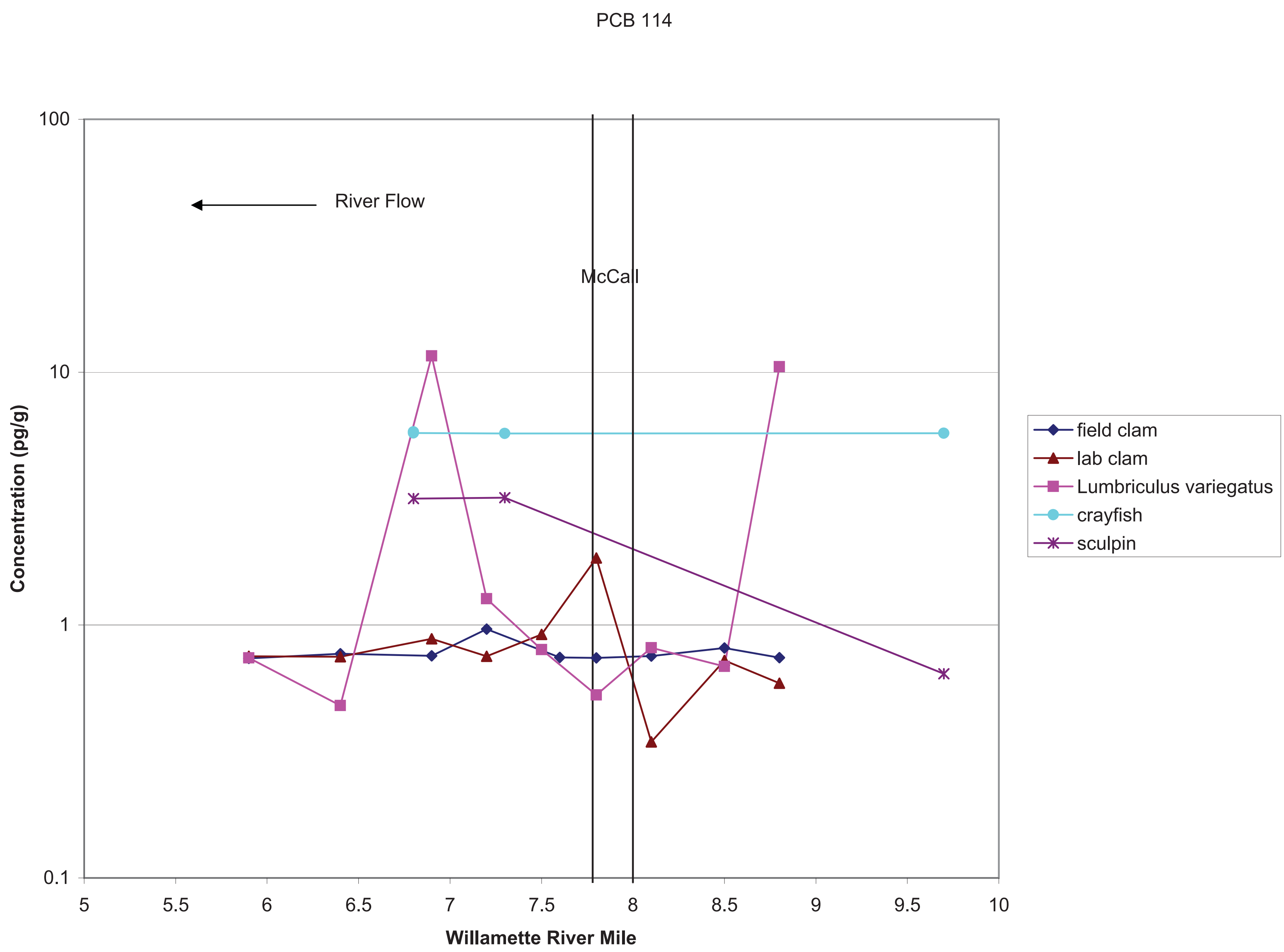


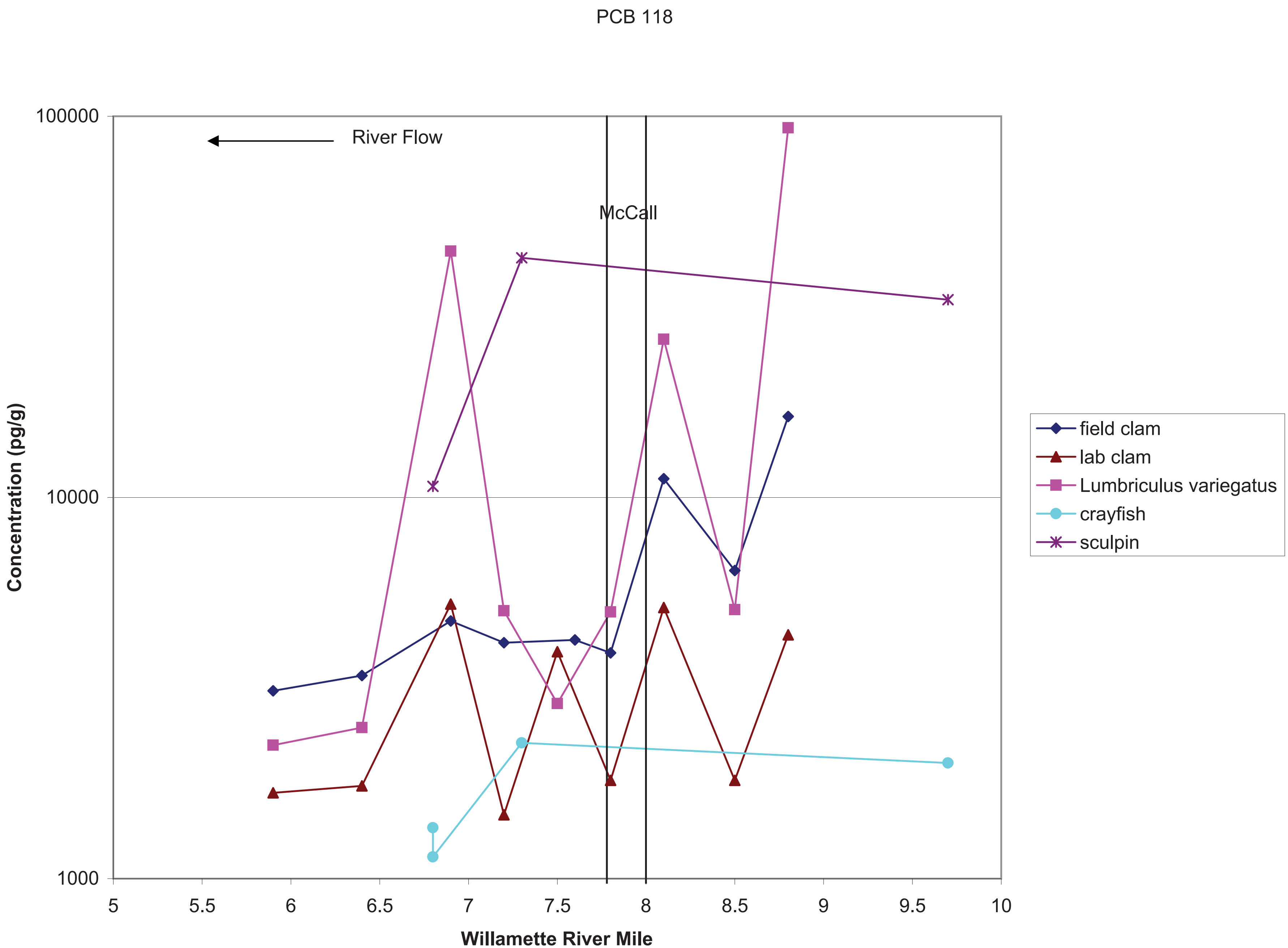
PCB 77
River Flow
McCall
Concentration (pg/g)
100000
10000
1000
100
10
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

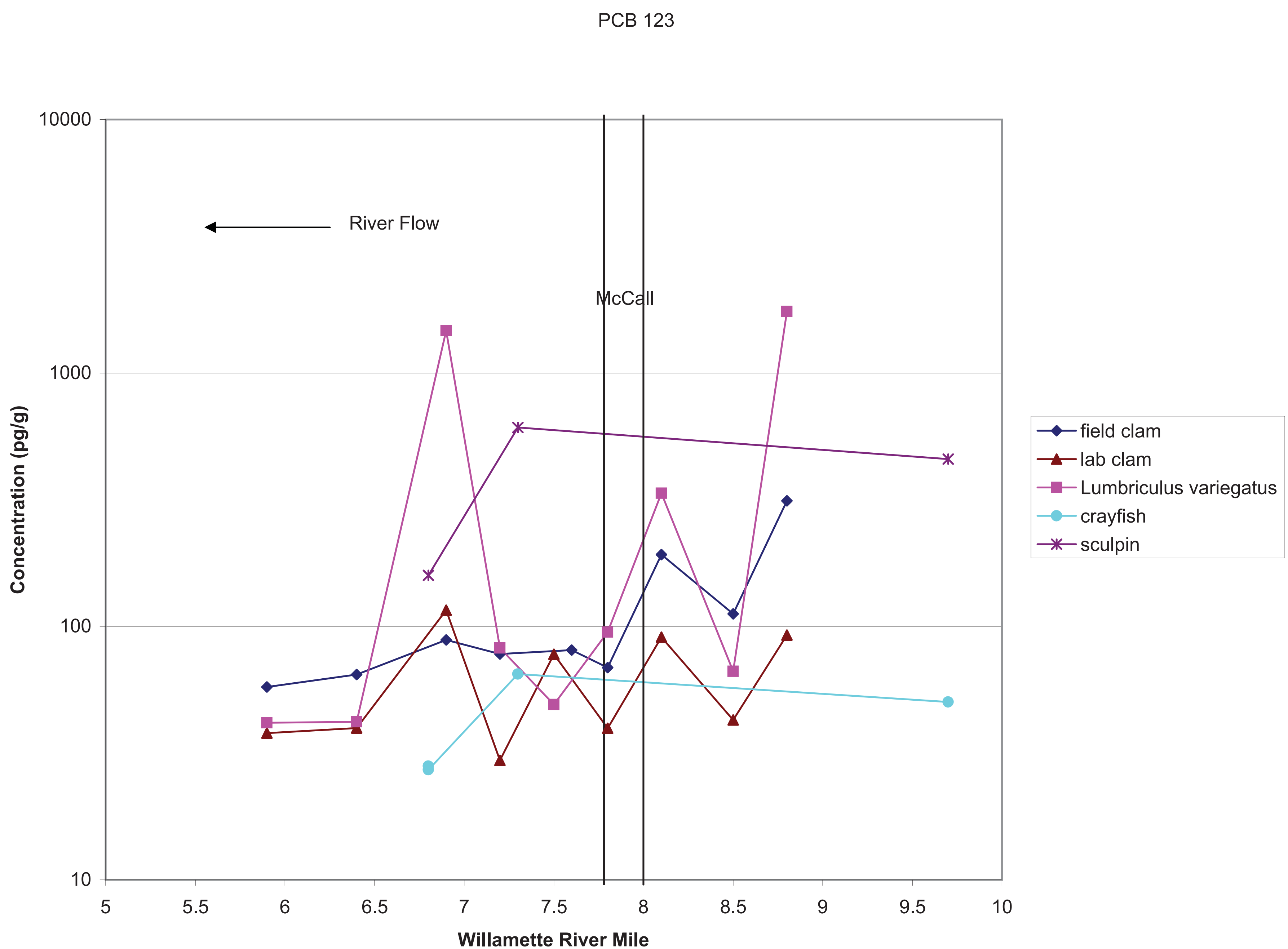


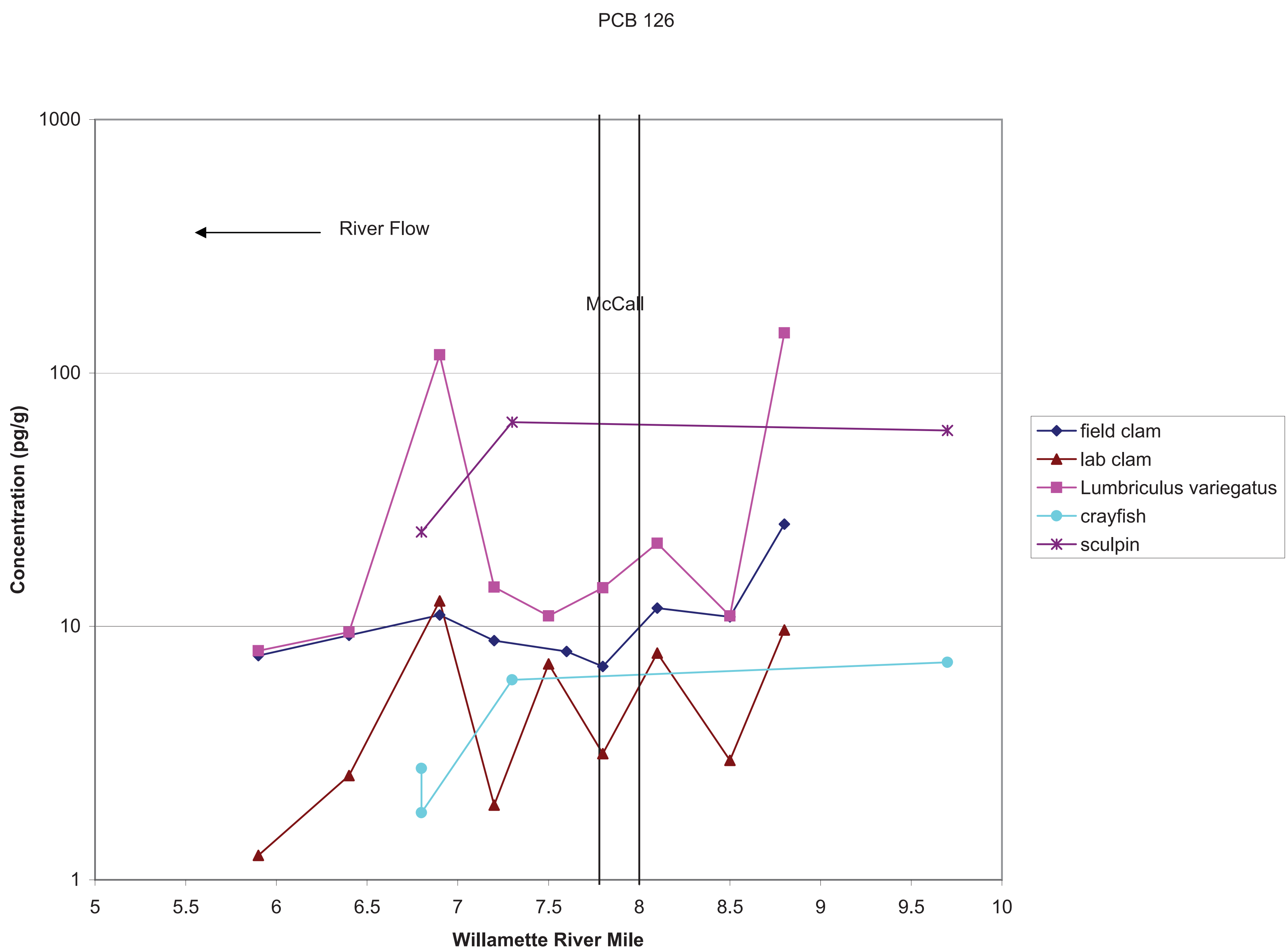
PCB 81
River Flow
McCall
Concentration (pg/g)
1000
100
10
1
0.1
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin


PCB 105
River Flow
McCall
Concentration (pg/g)
Willamette River Mile
100000
10000
1000
100
10
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

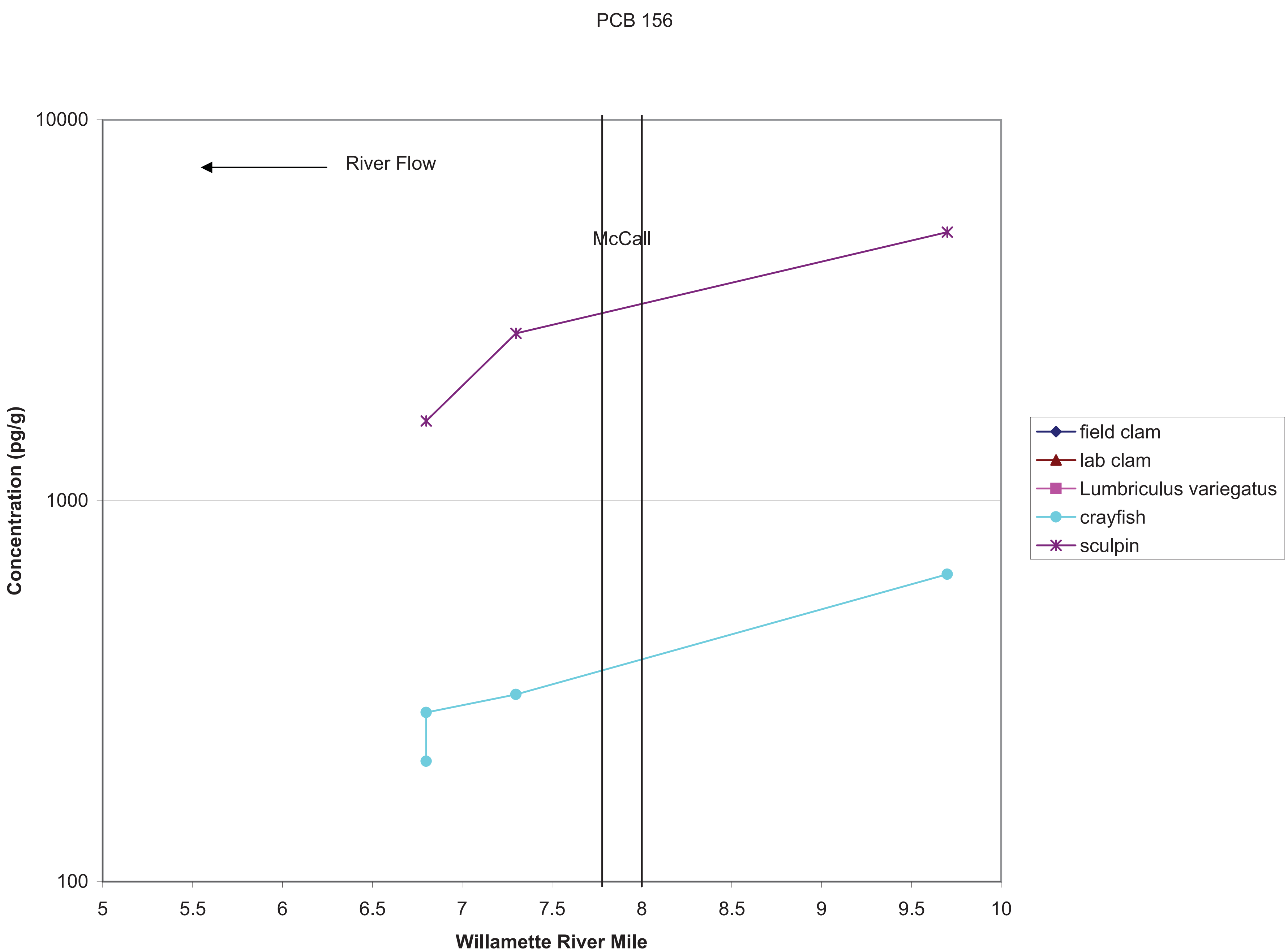

PCB 114
River Flow
McCall
100
10
1
0.1
Concentration (pg/g)
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

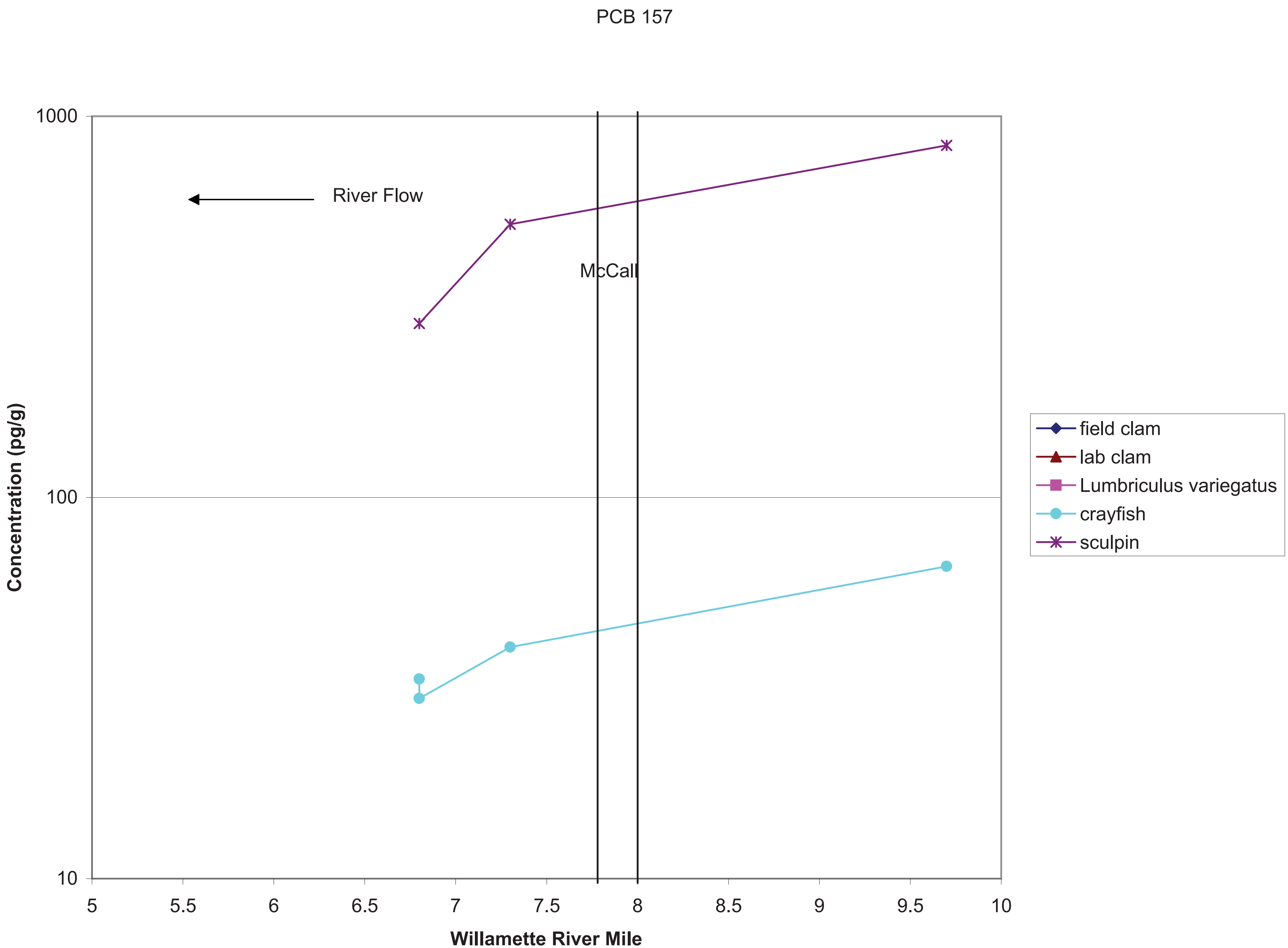

PCB 118
River Flow
McCall
100000
10000
1000
Concentration (pg/g)
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin


PCB 123
River Flow
McCall
Concentration (pg/g)
10000
1000
100
10
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

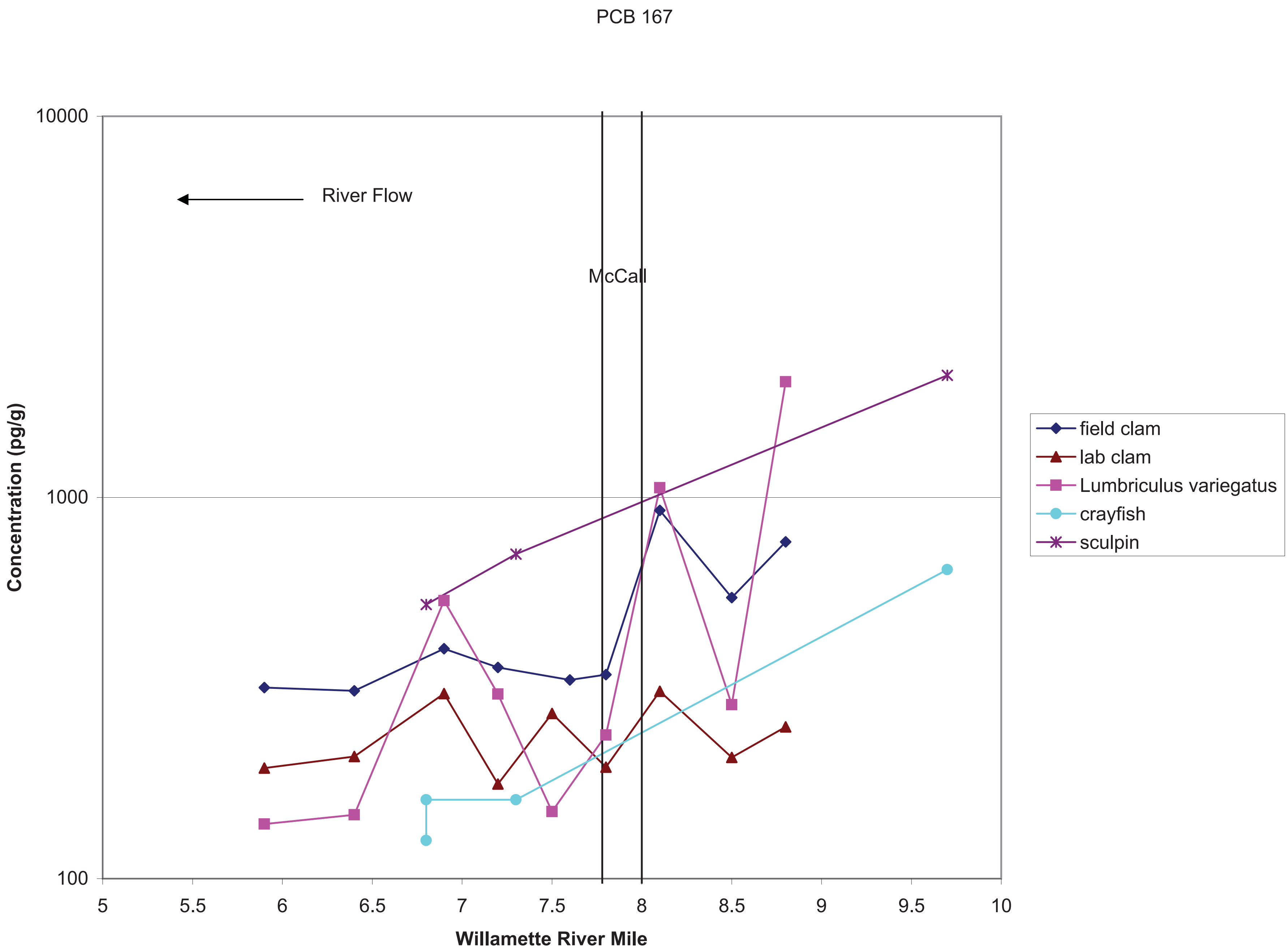


PCB 126
River Flow
McCall
Concentration (pg/g)
1000
100
10
1
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

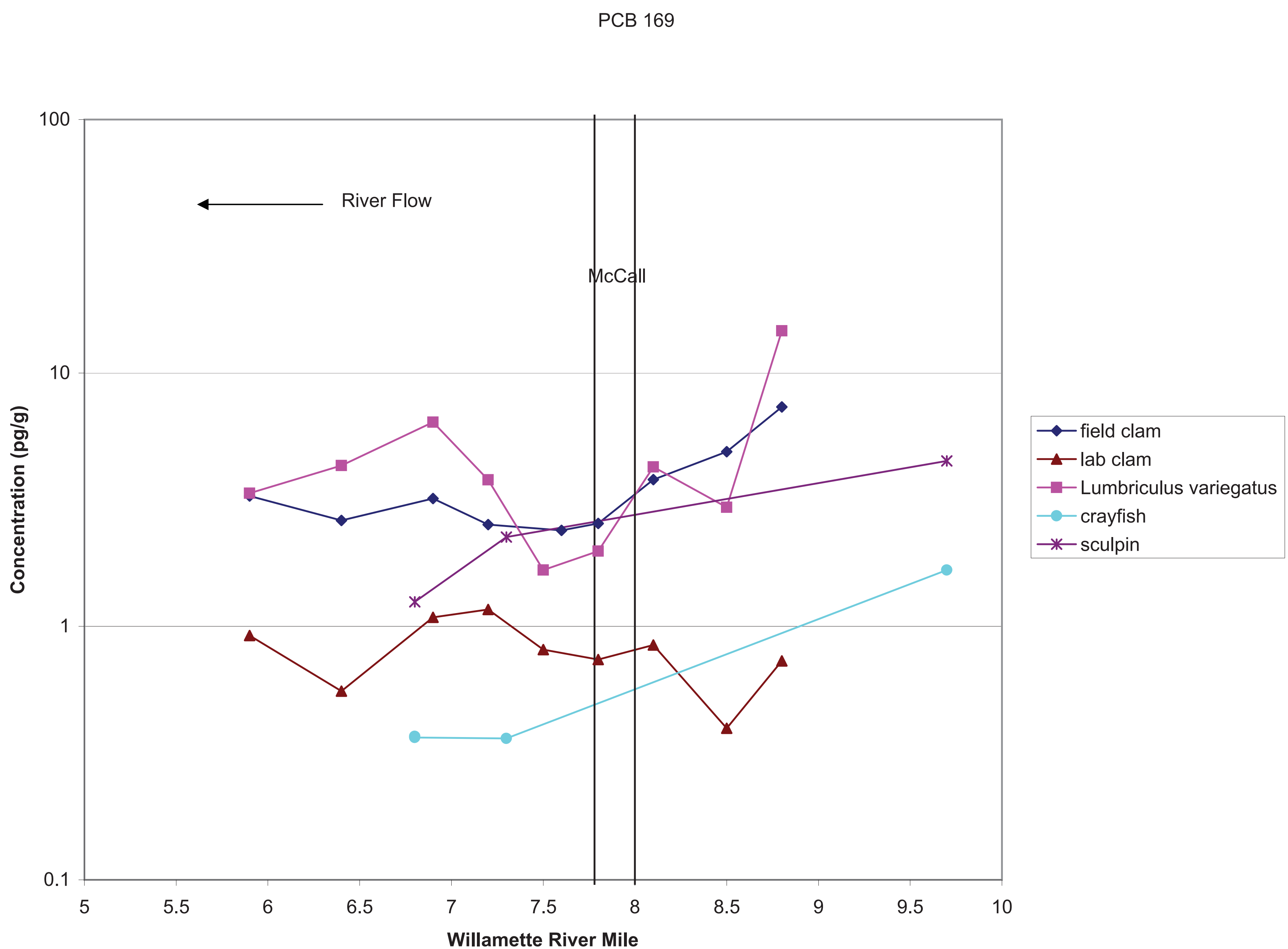

PCB 156
10000
1000
100
Concentration (pg/g)
River Flow
McCall
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

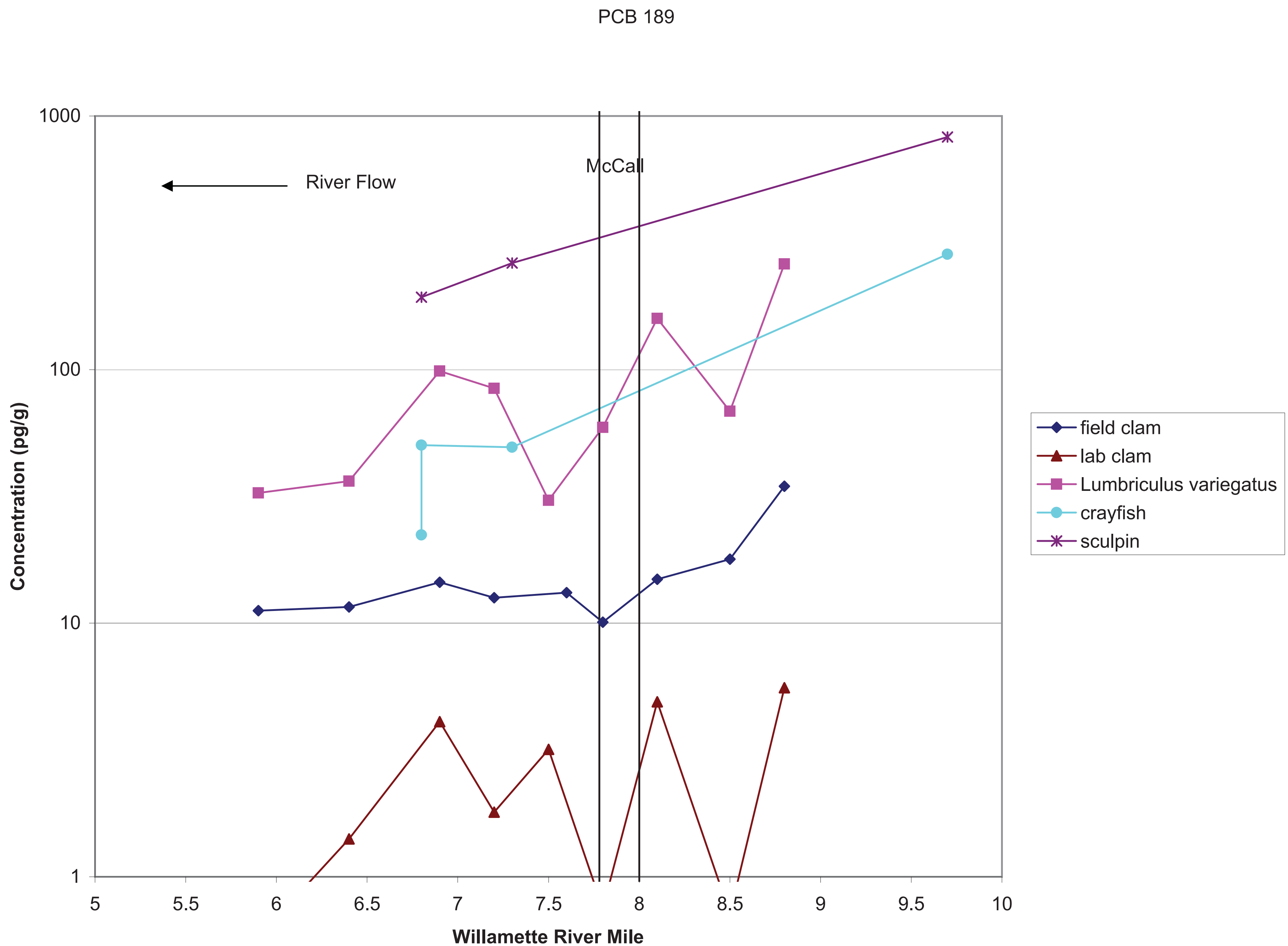


PCB 157
River Flow
McCall
Concentration (pg/g)
1000
100
10
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin



PCB 167
10000
1000
100
River Flow
McCall
Concentration (pg/g)
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

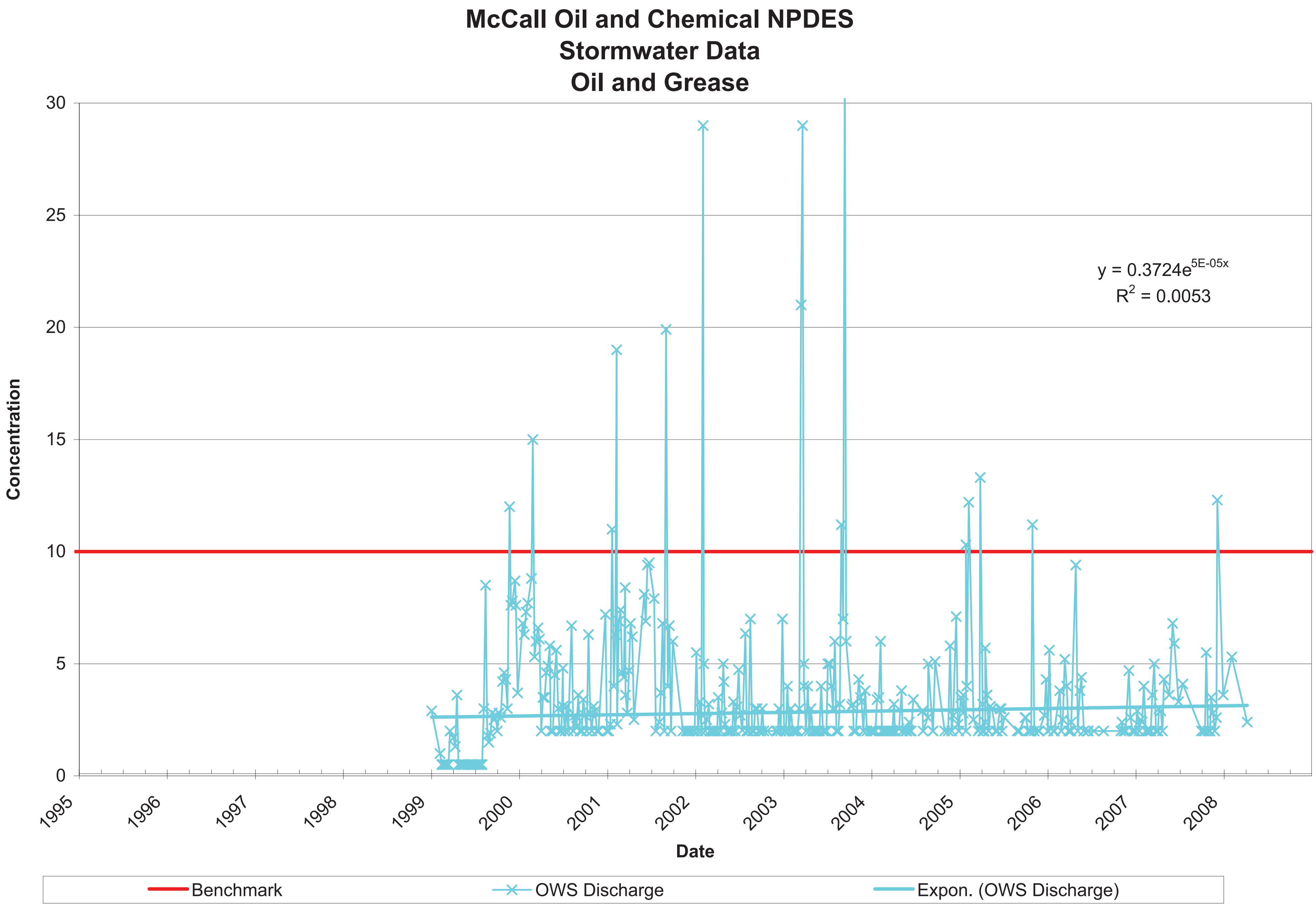

PCB 169
River Flow
McCall
100
10
1
0.1
Concentration (pg/g)
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin



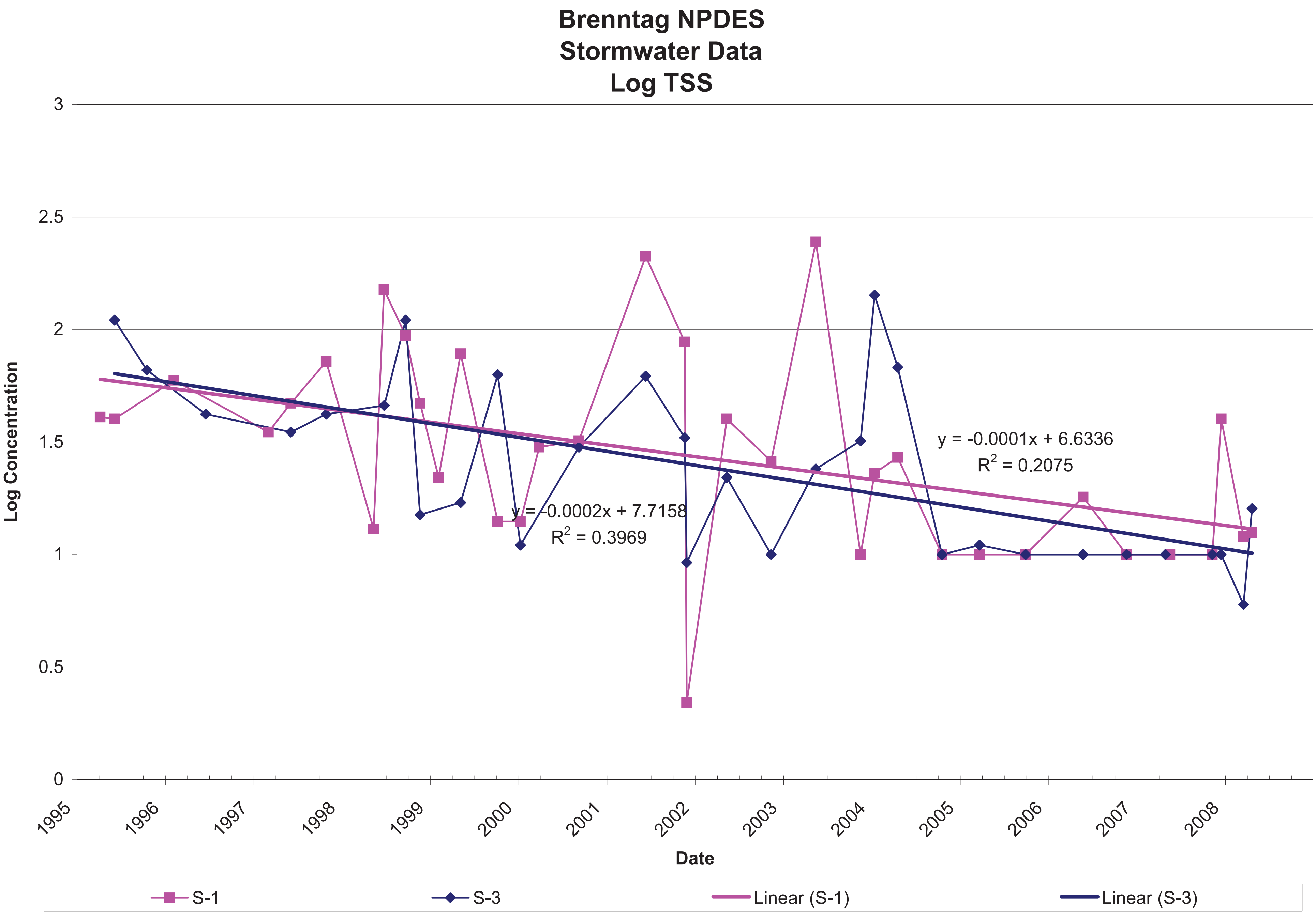
PCB 189
1000
100
10
1
Concentration (pg/g)
River Flow
McCall
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
Willamette River Mile
field clam
lab clam
Lumbriculus variegatus
crayfish
sculpin

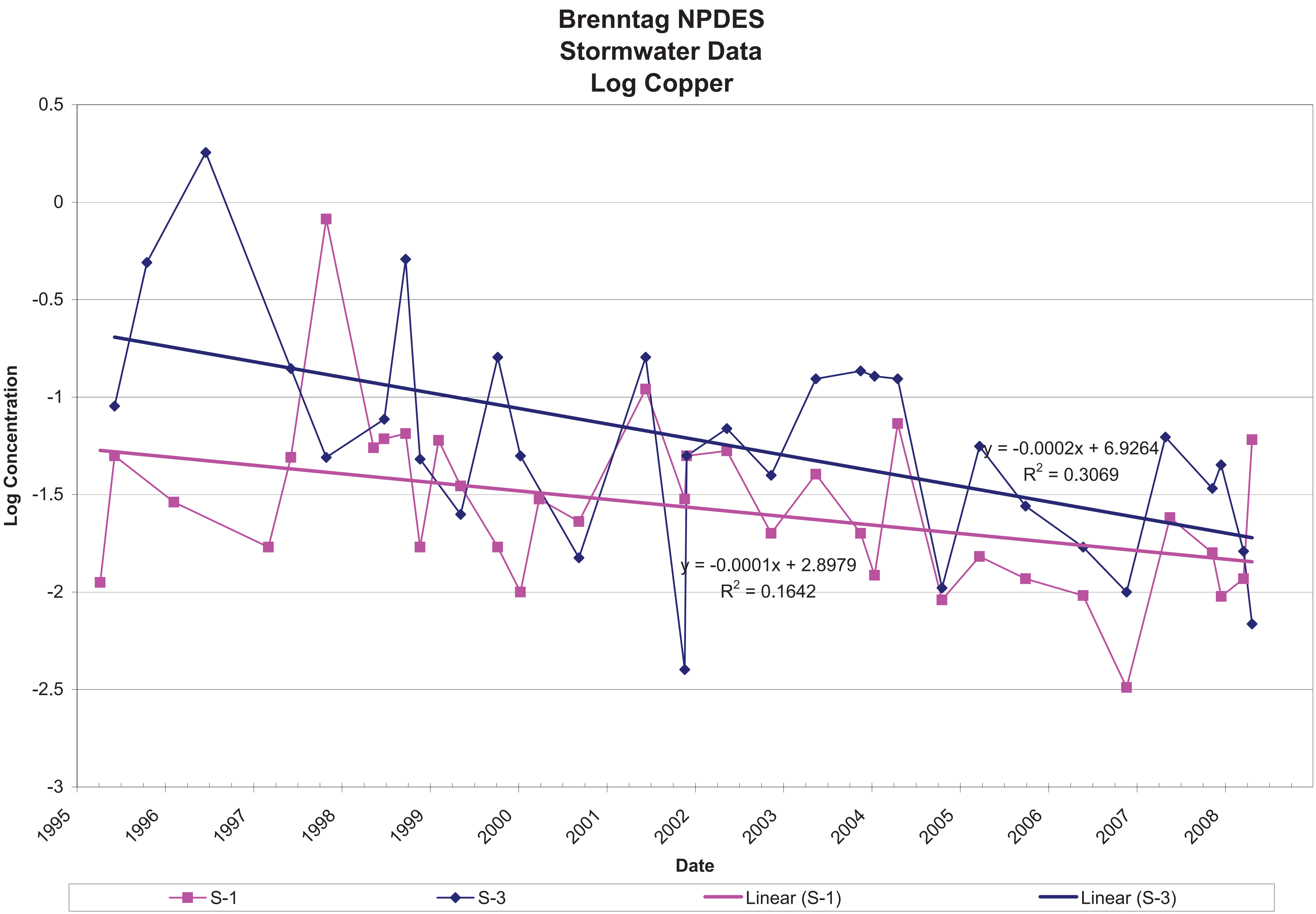
APPENDIX C

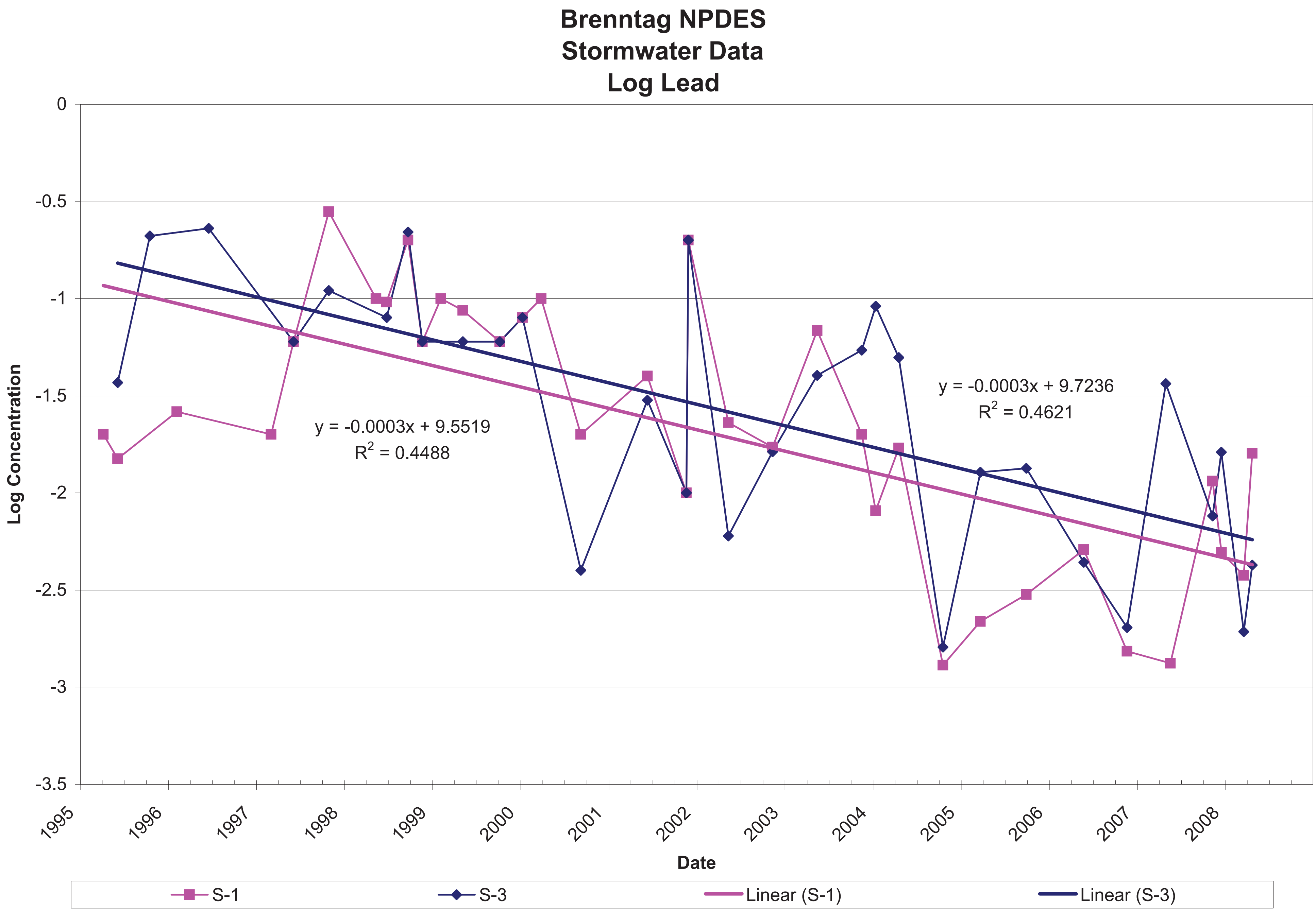
REGRESSION ANALYSIS OF NPDES MONITORING DATA



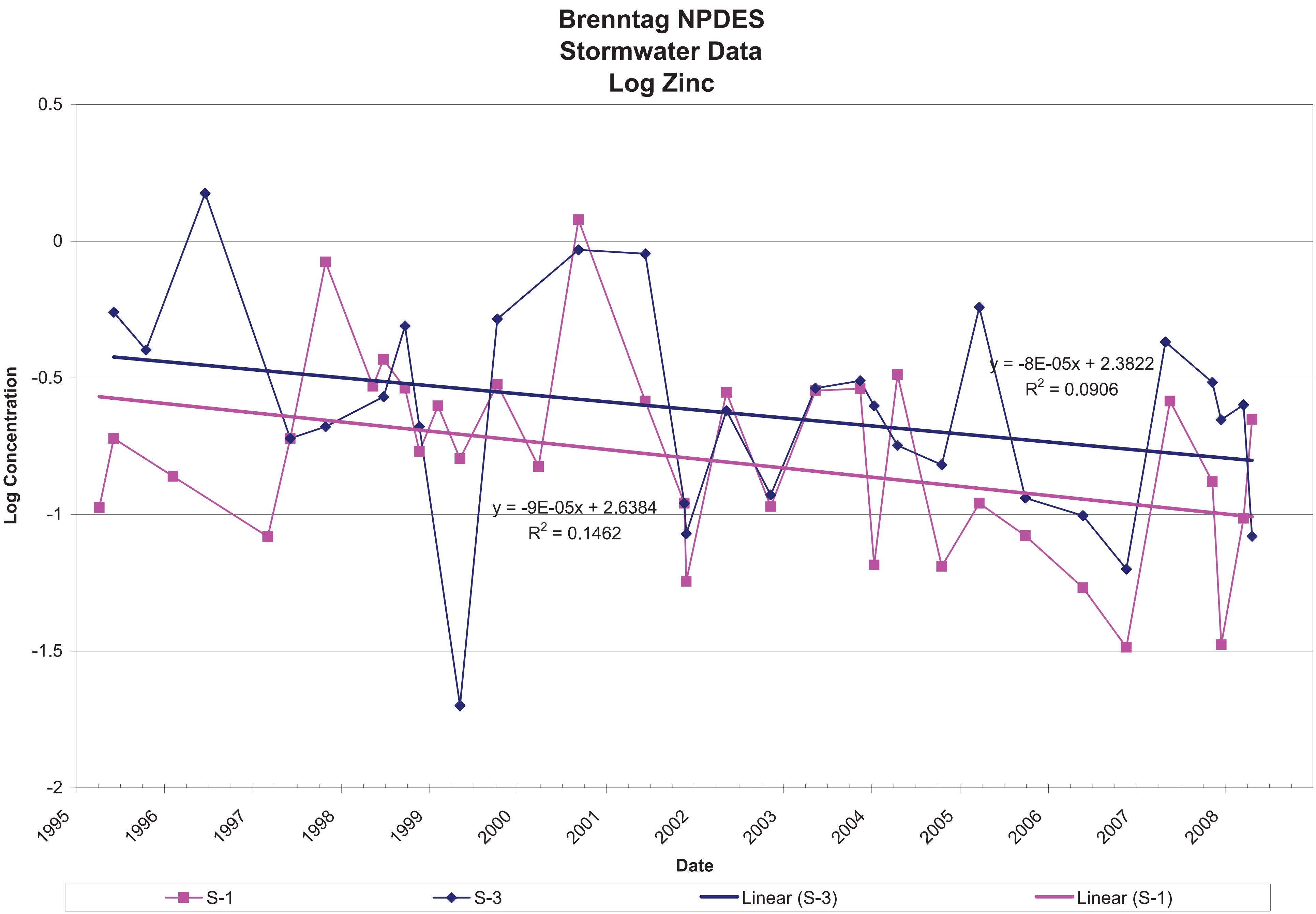
McCall Oil and Chemical NPDES
Stormwater Data
Oil and Grease
Concentration
Date
$y = 0.3724e^{5E-05x}$
$R^2 = 0.0053$
Benchmark
OWS Discharge
Expon. (OWS Discharge)
0
5
10
15
20
25
30
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008

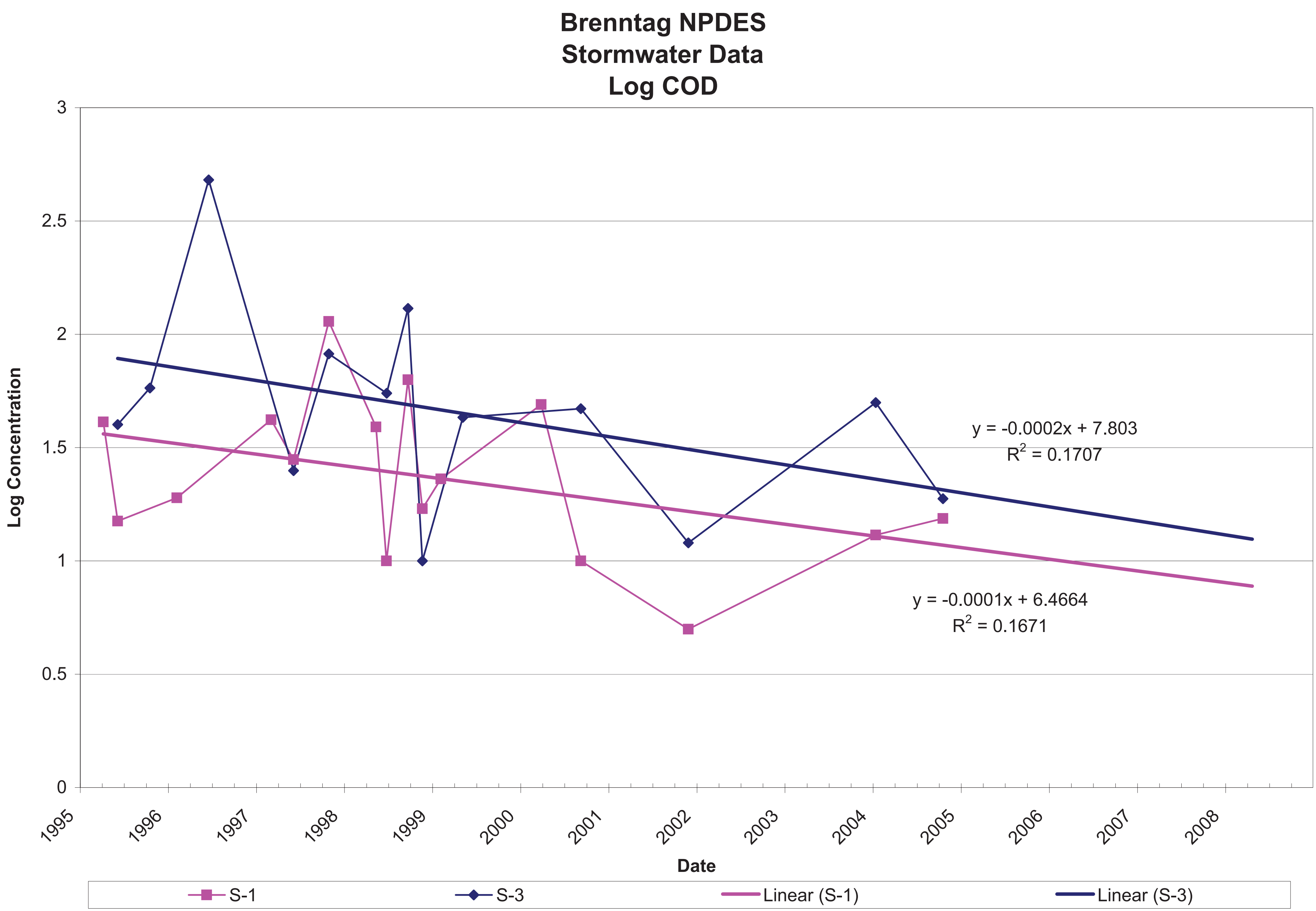

Brenntag NPDES
Stormwater Data
Log TSS
Log Concentration
3
2.5
2
1.5
1
0.5
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Date
y = -0.0002x + 7.7158
R^2 = 0.3969
y = -0.0001x + 6.6336
R^2 = 0.2075
S-1
S-3
Linear (S-1)
Linear (S-3)


Brenntag NPDES
Stormwater Data
Log Copper
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
Log Concentration
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Date
y = -0.0002x + 6.9264
R^2 = 0.3069
y = -0.0001x + 2.8979
R^2 = 0.1642
S-1
S-3
Linear (S-1)
Linear (S-3)



Brenntag NPDES
Stormwater Data
Log Lead
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
Log Concentration
y = -0.0003x + 9.5519
R^2 = 0.4488
y = -0.0003x + 9.7236
R^2 = 0.4621
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Date
S-1
S-3
Linear (S-1)
Linear (S-3)


Brenntag NPDES
Stormwater Data
Log Zinc
0.5
0
-0.5
-1
-1.5
-2
Log Concentration
y = -8E-05x + 2.3822
$R^2 = 0.0906$
y = -9E-05x + 2.6384
$R^2 = 0.1462$
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Date
S-1
S-3
Linear (S-3)
Linear (S-1)



Brenntag NPDES
Stormwater Data
Log COD
Log Concentration
3
2.5
2
1.5
1
0.5
0
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Date
y = -0.0002x + 7.803
R^2 = 0.1707
y = -0.0001x + 6.4664
R^2 = 0.1671
S-1
S-3
Linear (S-1)
Linear (S-3)